THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 51 Thursday, October 18, 1934 No. 948

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF

The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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A Debt Repaid

The annual Motor Exhibition at Olympia has aroused the usual interest and enthusiasm, both amongst the general public and in the ranks of those more intimately connected with the industry. It has, in fact, become a commonplace in recent years for each successive exhibition to be hailed as an indication of still greater triumphs on the part of the motor manufacturers in meeting the needs and desires of the motoring public with that combination of quality and economy which is its own guarantee of success. There can certainly be no doubt that the automobile industry is enjoying a period of prosperity simply as a result of the application of the principle of supplying better products in greater quantities, and thus at lower prices. It is not uninteresting, therefore, to reflect upon the repercussions of this state of affairs upon the foundry industry in general, and in particular upon those foundries engaged in the production of automobile castings.

It is no exaggeration to say that during the years since the war the foundry industry has become increasingly indebted to the foresight and enterprise which have characterised the managerial policy of the larger automobile firms. This debt extends far beyond the mere volume of orders and contracts placed. The demand for enormous quantities of high-grade castings of absolutely uniform properties and dimensional accuracy has been a constant stimulus to the development of foundry technique, and has resulted in the beneficial specialisation by various foundries in the production of such components as cylinder blocks, cylinder heads, pistons and brake drums. At the same time, the minor revolution which the foundry has undergone on the mechanical side is in large part attributable to the nature of these same demands. Foundry mechanisation would most certainly not have progressed to its present state without the background of ideas and experience in quantity production provided by the automobile industry.

Over the past two or three years, however, signs are not lacking that this debt is in course of being handsomely repaid. Not only have improved straight and alloy irons been made available, but cast iron has been shown to be a suitable material for components for which its employment would previously have been regarded as absurd. The results of research carried out both by individual foundries and by foundry organisations on such problems as cylinder bore and valve seat wear, porosity in cylinder heads, and the properties required in brake-drum materials have also been made available to the automobile engineer. Furthermore, those foundries which have specialised in automobile work are now in a position to offer advice upon the design of the parts they will be asked to produce, and in many cases, after they have become accustomed to the apparently unorthodox nature of this arrangement, designing engineers have found it to give much greater satisfaction to both parties. In such ways as these is the foundry industry now enabling the automobile industry to go still further ahead in offering low-priced high-quality cars to the public. Instead of the foundry industry being content merely to take in the engineers' washing, it has developed a measure of initiative of its own.

Expert Witnesses.—II

Following up a little further the effect of the legal change referred to in our last issue, it may well result in more frequent resource to legal process, for a large part of the consideration given to the prospect of success by any litigant must revolve round the question of expert testimony, round who can be employed to give it, and who will be retained by the other side. For with witnesses, as with lawyers, there is power in a great name. An eminent lawyer is said recently to have proposed that expert witnesses should not be paid, and thus the cost of legal actions would be reduced. We suggest as an alternative that lawyers themselves be not paid and costs would then be reduced to almost negligible proportions.

In our view, the expert witness who is expected to do his best for those who retain him is in this respect no worse off than most of the employees of a company, such for example as salesmen. Moreover, the best and most reputable experts will not distort the truth even for a client. Their reputation depends on their impartiality, and the opponent of to-day may well be the client of to-morrow. In this connection, reference may be made to the increasing difficulty of securing experts. The growth of industrial groups and the increase in specification both tend to make it very difficult to secure the services of a really independent and fully-qualified expert. Frequently, in cases where an independent opinion is required, recourse is had to the President for the time being of whatever technical or scientific body is concerned with the field of work in question, but specialisation to-day is such that this offers no real guarantee of expertness, even if it does offer a guarantee of independence. Again, the professors and lecturers at the universities and university colleges are often consulted because they are, in a sense, servants of the community and hence their independence is taken for granted. But cases have arisen where the receipt of funds really undermines this independence. The working of the new rules will be watched with great interest.

XUM

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Mechanisation, Hand Production and Output

To the Editor of The Foundry Trade Journal.

Sir,—Your correspondent, "The Manager of a Continental Foundry," in his letter which appeared in your issue of October 11, feels that his experience of mechanisation runs counter to the views contained in the article of August 9, on "Box Parts in Quantity Production"; but are not the views there expressed most accurately borne out by his statement? He "realises the risk of over-mechanisation"; in other words, he sees the impossibility of complete mechanisation. He possesses evidence that "simple, cheap, gravity conveyors introduce considerable saving of time and wages." In fact, in the words of the article, he has "wisely rounded off his sand-handling and moulding-machine equipment" precisely in the manner recommended in the first paragraph. A gravity conveyor is no more a component of mechanisation than a hand crane or a platform truck, but as a means of transport it has obvious advantages, and there was certainly no intention to belittle its virtues in the article referred to.

Mention of the hand production of railway chairs rather naturally had reference to the British railway chair, which is considerably larger than the chair made by your correspondent. The British chairs when made in twos require a box 18 in. by 20 in., with a 3½ in. deep top and 10 in. deep drag. The complete box would weigh roughly twice the weight of the 17 in. by 16 in. by 2 in. by 6-in. box which he is using. Any production figures, therefore, would be useless for purposes of comparison. Even so, there is at least one railway foundry in this country in which two men and one boy, working together, mould by hand on an average 55 of these chairs per hr.; a performance which has not been equalled or approached by any moulding machine within the knowledge of,—Yours, etc.,

"The Writer of the Article."

Publication Received

Kelly's Directory of the Engineering, Hardware, Metal, and Motor Trades, 1934. Published by Kelly's Directories, Limited, 106, Strand, London, W.C.2. Price 45s. post free.

Never in the history of the industrial development of Great Britain has the need for directories of a reliable type—and this one is definitely reliable—been greater than at the present time. Not only does the character of the output of firms constantly change, but amalgamations of firms are constantly being formed and dissolved. The formation of subsidiary companies and the resurrection of old names as merely holding concerns is constantly adding to the complexity of modern business. This directory is first arranged on a geographical basis, running through each county, town and village of England, Scotland and Wales, and listing the works they contain. Then follows a section of which classifies the trades operated in the London area, and finally a similar section for the provinces. There are in addition to the above, which takes 2,628 pages to cover, sections which contain lists of manufacturers of iron and steel sections; of proprietary articles and trade names more than 10,000 are included, and of brands on iron and steel work. We always consider that the list of towns and villages which appear in standard directories of this character is extremely useful, as a commercial representative can often fill in his time to better advantage if he is armed with advance knowledge of the existence of other establishments near to the object of his call.

Colonel Cheesewright

At the age of 64, Colonel W. F. Cheesewright, D.S.O., died suddenly last Friday at Paddington. Whilst he was perhaps more widely known in the iron, steel and coal trades, his association with the foundry industry dates back to 1904, when Eagland & Company, Limited, of which firm he was advertising manager, bought the two-year-old Foundry Trade Journal. He gave sympathetic and practical encouragement to the formation of the British Foundrymen's Association. During the war he was on active service, being mentioned in despatches, and retiring with the rank of colonel.

In 1921 The Foundry Trade Journal was made a weekly newspaper, and by that time Colonel Cheesewright had become joint managing director—a position which allowed him to devote more of his time to technical institutes. He was elected to the Council of the London Branch of the Institute, which was then beginning to make steady progress. He revived the annual dinner, and his breezy after-dinner speeches were among the great attractions of these functions. He helped to build up the Branch from a handful of members to the second largest of all, due to a natural desire to render some personal service to everybody with whom he made contact. To be a friend of the Colonel's meant access to a large circle of people, for no man had a greater capacity for making lasting friendships. His creed was largely responsible for the international technical co-operation of the foundry industry, for in 1922 Colonel Cheesewright, together with H. Cole Estep and Oliver Stubbs, both of whom predeceased him, organised a luncheon party for all the foreign visitors to the first foundry exhibition held in Birmingham. At this function the seeds of international co-operation were planted. The enthusiasm created was such that every country wanted to be host at the earliest opportunity, and it fell to the lot of the writer and Mr. Paul Ropsy to restore order out of chaos by the creation of the International Foundrymen's Technical Committee in 1926.

In later years Colonel Cheesewright's connection with the foundry industry became weakened, through no personal desire, and when he finally resigned from the Institute he presented the London Branch with a silver loving cup. Of his other activities we are unable to speak, but the writer's five years' personal and almost daily contact with the Colonel will ever remain one of the most happy memories of his life. His passing will be deeply regretted by foundry owners, managers, foremen and artisans wherever the art is practised. To Mrs. Cheesewright, Mr. and Mrs. Dewar (his only daughter) we offer on behalf of the foundry industry our sincerest condolences.

V. C. F.

Bright Future for Steel Trade.—According to an opinion expressed by Sir William Larke, K.B.E., director of the British Iron and Steel Federation, before a representative meeting of Scottish iron and steel industrialists in Glasgow, recently, the British steel industry may be producing at the rate of 11,000,000 tons per annum in a year or 18 months. The present rate of output is almost up to the 1929 peak record, when 9,640,000 tons were produced. Home consumption at present is at the rate of 8,000,000 tons per annum, but this is likely to expand, and the export trade, although it has been disappointing, is improving. Sir William's account of the future prospects of the British steel trade was very optimistic. Trade in this country, he said, is recovering more rapidly than in other countries. He did not agree with the opinion expressed by Mr. Walter Runciman, M.P., not long ago, that the home consumption of steel had reached a point of saturation. Many new uses for steel had been developed, and many more possible outlets were under consideration.

Random Shots

"Marksman" is in a quandary. This is how he came to get into it. A few days back, he was visiting a number of country foundries—jobbing shops that will job any job that comes along. Most of them, if not exactly reminiscent of the vast mechanised bays of the Gayway Foundry, were at least run on very commonsense lines. With the exception of one, that is—a dilapidated looking place, in a small market town. "Marksman" drew his car into the yard, narrowly missing a tall stack of very rusty moulding boxes. He climbed out of the car, squeezing through the door, which could be only half opened because of another tall stack of equally rusty moulding boxes, and sidestepped a third stack of ditto to enter the foundry. Of this little will be said. "Marksman's" opinion of it is best summed up in asterisks, thus:—

* * *

Well, after the visit was over, when all the handshaking was done, "Marksman" squeezed into his car, started the engine and then—it happened! Something caused the car to backfire—to detonate, in fact—with extreme violence, and the sky became darkened with clouds of rich red dust. "Marksman" gave a panicky jump from the car and landed in the middle of the yard. "What ever has happened?" he gasped. "Happened?" stuttered the foundry proprietor. "Look what you've done to those moulding boxes, blank! blank! blank!" Litmus-like, the atmosphere changed immediately from red to blue.

"Marksman" looked. Where had stood those tall upstanding columns, now lay three heaps of powdered iron oxide. "They are the moulding boxes, they were!"

* * *

"Marksman" is now being threatened that a claim for damages will be brought against him. What is his position? And what, if such lasts, is the custom of the trade in respect to this? He would very much like to have authoritative advice from any of his legal-minded readers.

* * *

Whenever the word "Roman" is mentioned "Marksman" always pictures a tall muscular athlete who, with toga replaced by bathing shorts, would figure splendidly in any "Let me make a MAN of you" advertisement. But he is now disillusioned. Reading "Copper through the Ages," a publication issued recently by the Copper Development Association, he learns that the Romans were experts in artificial-leg production—and not for the export market only! One specimen, housed now in the Royal College of Surgeons' Museum, is described as "a delicately fashioned artificial leg, dating from about A.D. 300, made from bronze sheet which was originally fixed to a wooden core by bronze nails." The special Gladiator Model, do you think?

Marksman.

New Electric-Furnace Installation

The Kilby Car & Foundry Company at Anniston, U.S.A., is installing a steel-producing plant using electric-arc reduction. By November 20 the initial unit is expected to be producing ingots at the rate of 1,000 gross tons per month. The special process adopted is employed only in Seattle, Washington, and Montreal, Canada, the new plant being only the third of its kind on the North American Continent. The furnace will have a charge capacity of 6 tons and will permit the company to pour about 70 tons of ingots every 24 hrs. in plain carbon billet size. It will be operated with a basic lining and using graphite electrodes. On production of plain carbon steels, this type of furnace ordinarily turns out 12 to 14 heats of 4.5 to 5.5 gross tons per heat every 24 hrs. The graphite electrode consumption is expected to be about 7 lbs. per gross ton and the electric energy consumption is estimated not to exceed 700 kw.-hrs. per gross ton. The initial installation will require a capacity of 2,500 kilowatts.

XUM

The Foundry of Ford Motor Company at Dagenham*

By Vincent C. Faulkner and J. N. Burns

There is probably no foundry in Great Britain which presents so many features of outstanding interest to foundrymen as the one established by the Ford Motor Company at their Dagenham Works (Fig. 1), because, prior to its construction, the company had a wealth of experience of the quantity production of castings, both at Detroit and Cork. This experience has, in the main, had the result of placing at the disposal of the management a maximum of elasticity in production and facilities for control in quality, viewed from no matter what angle. A third factor, that of the reduction of handling costs is the result of intensive study and development of lay-out. It is a natural phenomenon, everywhere experienced where efforts are consistently made to handle large quantities of material in an orderly fashion, so as to provide an engineering factory with a continuous yet variable supply of high-grade castings. The only method available is by utilising conveyors of various types to the fullest extent.

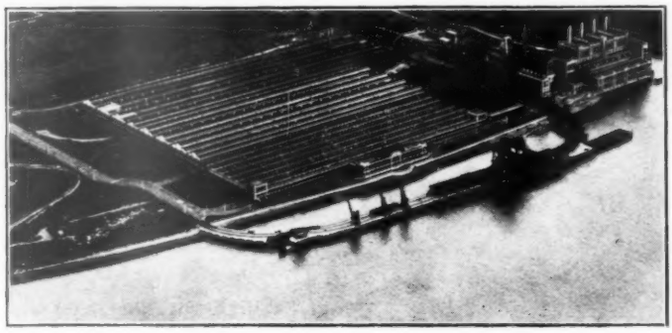


Fig. 1.—Aerial View of the Ford Motor Company's Works at Dagenham.

Fig. 2.—The Blast-Furnace Plant, showing the Furnace Top and Hot-Blast Stoves.

Whilst most large foundries have provided themselves with facilities for procuring the requisite quantities and qualities of liquid metal for use in their shops, no other concern has ventured so far as the Ford Company. As is well known, a blast furnace (Fig. 2) has been erected, together with coke ovens and sintering plant (Fig. 3). Every conceivable aid is given to the blast-furnace manager to produce pig-iron of a uniform quality. A pre-arranged charging programme is supplied to the scale-car operator, and each charge of raw materials is automatically weighed before being dumped into the furnace-charging skip (Fig. 4). To ensure correct sequence of charging for various raw materials, automatic recording switches are fitted to the coke, ore and limestone hopper gates, and a record of each charge is made in a central chart room. To make certain of an equal distribution of the charge, a revolving top has been fitted to the blast furnace, and as each charge is dumped into the small bell, this distributing table revolves through a predetermined arc. At the top of the furnace is fitted an automatic level indicator and also automatic temperature-control apparatus.

Should the temperature of the furnace exceed a predetermined figure, special time-relay electrically-operated valves spray the incoming charge, at the loading point, with a definite quantity of water. This system ensures uniform heating conditions and lays the foundation for a uniform heat cycle throughout the furnace. The hot-blast temperature is automatically controlled, and the furnace is assured of an accurate quantity of air being delivered at the required temperature within very close limits of variation. On tapping (Fig. 5), the metal is poured into 75-ton ladles (Fig. 6), which ensures that the whole cast is of one analysis.

It is interesting to note that the system of control installed has been extremely successful, and there is probably no other furnace in the world producing iron at such uniform predetermined analysis.

For the purpose of record for both the stock department and the metallurgical department, the charge (Fig. 6) is accurately weighed before entry into the hot-metal building. Over a production of some 40,000 tons the widest variation between any two casts has been:—Si 0.4, P 0.1 and Mn 0.3 per cent.

However, in addition to the precautions to institute a rigid control of the blast-furnace product, the Ford Motor Company has progressed a stage further in eliminating the unavoidable variations when dealing with Nature's raw materials—iron ores, limestones and coals. Early in the cycle of operations, a further control begins by transferring the liquid pig-iron to a coke-oven gas or tar-fired 600-ton mixer (Fig. 7), which effectually neutralises any temporary variation from standard or at the very least provides the metallurgist with a large reservoir of metal of known composition. To alter the analysis of 600 tons of material is not easy—that is one of its virtues! Thus the next step was to provide a pair of mixers of 150 tons

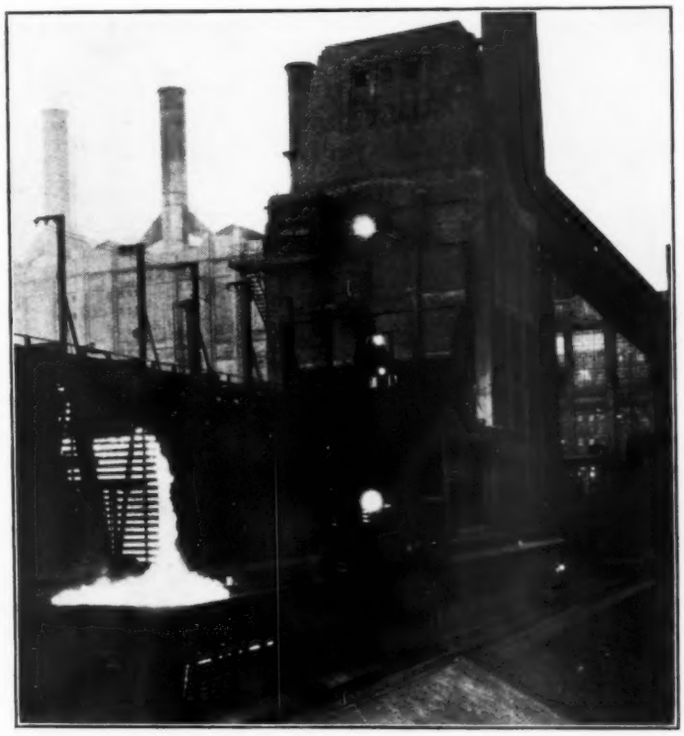


Fig. 3.—The Coke-Oven Plant, showing an Oven being discharged into a Wagon prior to Dry Quenching.

* A Paper read before the London Branch of the Institute of British Foundrymen, Mr. F. O. Blackwell presiding.

capacity. These then receive and hold this quantity of liquid iron of known composition for use by the foundry, but it is obvious that it would only be an accident if it fulfilled in every detail the rigid specificational requirements of the modern automobile foundry. Any necessary adjustment of composition could, of course, be effected by cold additions of alloys and ferrous scrap of known and suitable composition, but this, naturally, would have a pronounced effect on temperature and, in general, would not appeal to the metallurgist as being practical. The next step, therefore, was to provide a special cupola plant (Fig. 8), complete with ladle-car scales (Fig. 9), in order that the additions could be made in the liquid form, as it is comparatively easy to cupola-melt iron a little higher in silicon or of slightly lower manganese content to adjust the mixer-metal composition. Still, the metallurgist would have his objections, based on, maybe, the existence of graphite nuclei, emanating from the blast-furnace metal or some other theory based on "inherancy." Thus, provision has been made for the effectual overcoming of these objections by providing two 15-ton electrode electric furnaces[1] (Fig. 10). This enables the metallurgist easily to adjust both composition and temperature, and to have on tap at any given moment metal of a composition complying with specificational requirements. Moreover, this plant is supplemented by a large range of cupolas, whilst the final feature of metal control is the provision of what is virtually a pig-casting machine for returning to stock any iron which is insufficiently hot or of dubious composition.

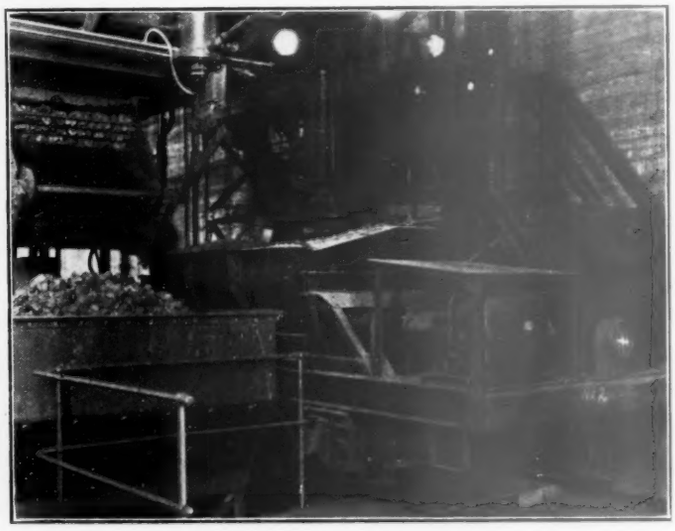


Fig. 4.—Furnace-charging Skip. All Material is Carefully Weighed before Reaching the Top of the Furnace.

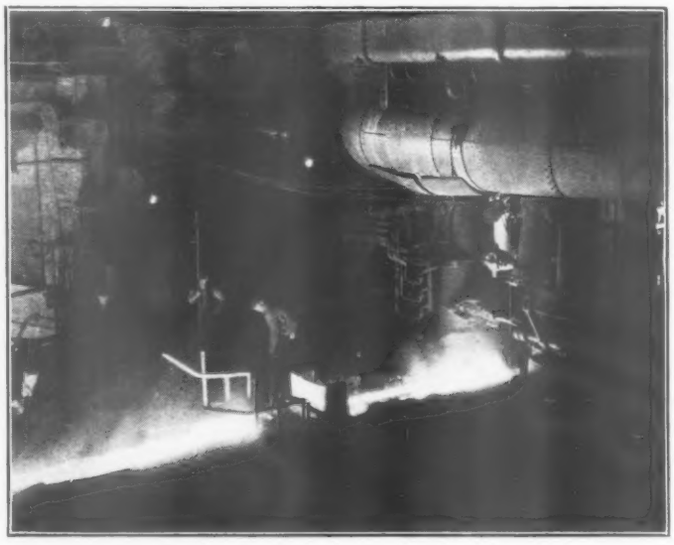


Fig. 5.—Tapping the Blast Furnace. No Sand-cast Pig is Made.

At the moment, as the output of the blast furnace is considerably in excess of the domestic requirements, the hot-metal plant is operating chiefly on producing refined grades of pig-iron for the home market (Fig. 11). For straight blast-furnace pig-iron the metal is taken direct from the ladle car to the pig-casting machine (Fig. 12), from whence it is automatically discharged into 50-ton steel trucks (Fig. 13), which are hauled by Diesel-engine locomotives to the pig-storage yard.

The analysis of this foundry iron is:—T.C., 3.50 to 3.60; Si, 3.2 to 3.75; Mn, 0.6 to 0.8; S, 0.024; and P, 0.35 to 0.45 per cent. max., and this composition was established through intense experiment and research. With pig-iron of this analysis the Ford Motor Company is able to produce continuously castings varying from the intricate 8-h.p. model cylinder block, where the wall thickness is $\frac{1}{8}$ in. and must withstand a hot gas pressure of 500 lbs. per sq. in., to the heavy tractor front wheel, weighing 230 lbs., and a cross-section of $1\frac{1}{2}$ in., with a remarkably low scrap percentage, actually less than 1 per cent.

On arrival at the stock yard, the pig-iron is discharged by Diesel-electric travelling jib cranes fitted with 4-ft. dia. electro-magnets (Fig. 14), and segregated into groups of within 0.25 per cent. limits of silicon. A sample is taken prior to pouring, so that there is no question as to its analysis and its storage location. To ensure adequate continuity of supplies, considerable stocks of pig are held in readiness for any emergency.

It is worthy of note that during the first month of operations the blast furnace produced only 1.5 per cent. of off-grade iron, and since those first two casts, no off-grade iron has been produced.

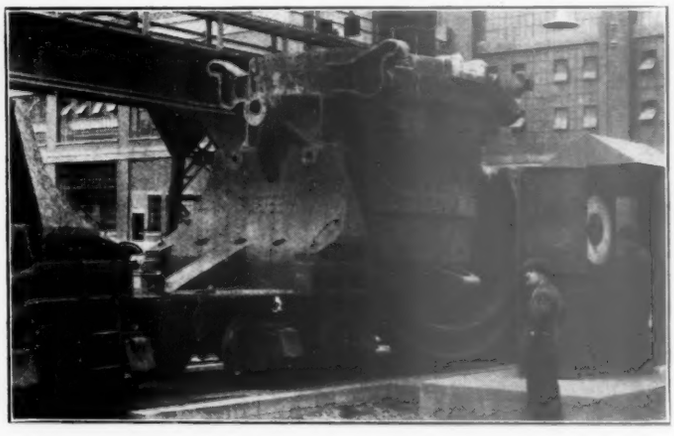


Fig. 6.—Metal is received into 75-ton Capacity Ladles, which are shown here at the Weighing Platform.

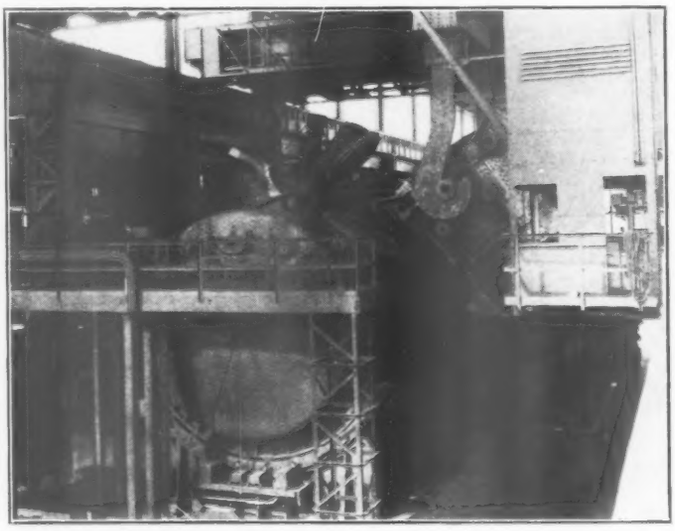


Fig. 7.—A 600-ton Mixer ensures a Large Volume of Controlled Analysis Iron.

General Description of the Foundry

From one angle the Ford foundry can be considered as a factory possessing five moulding units with common services for the supply of liquid metal and raw sand, two core departments, and departments for the cleaning of its products and for the provision of patterns. In addition, malleable castings are made. The

[1] A description of these, by P. Fox-Allin, appeared in Foundry Trade Journal on March 30, 1933.

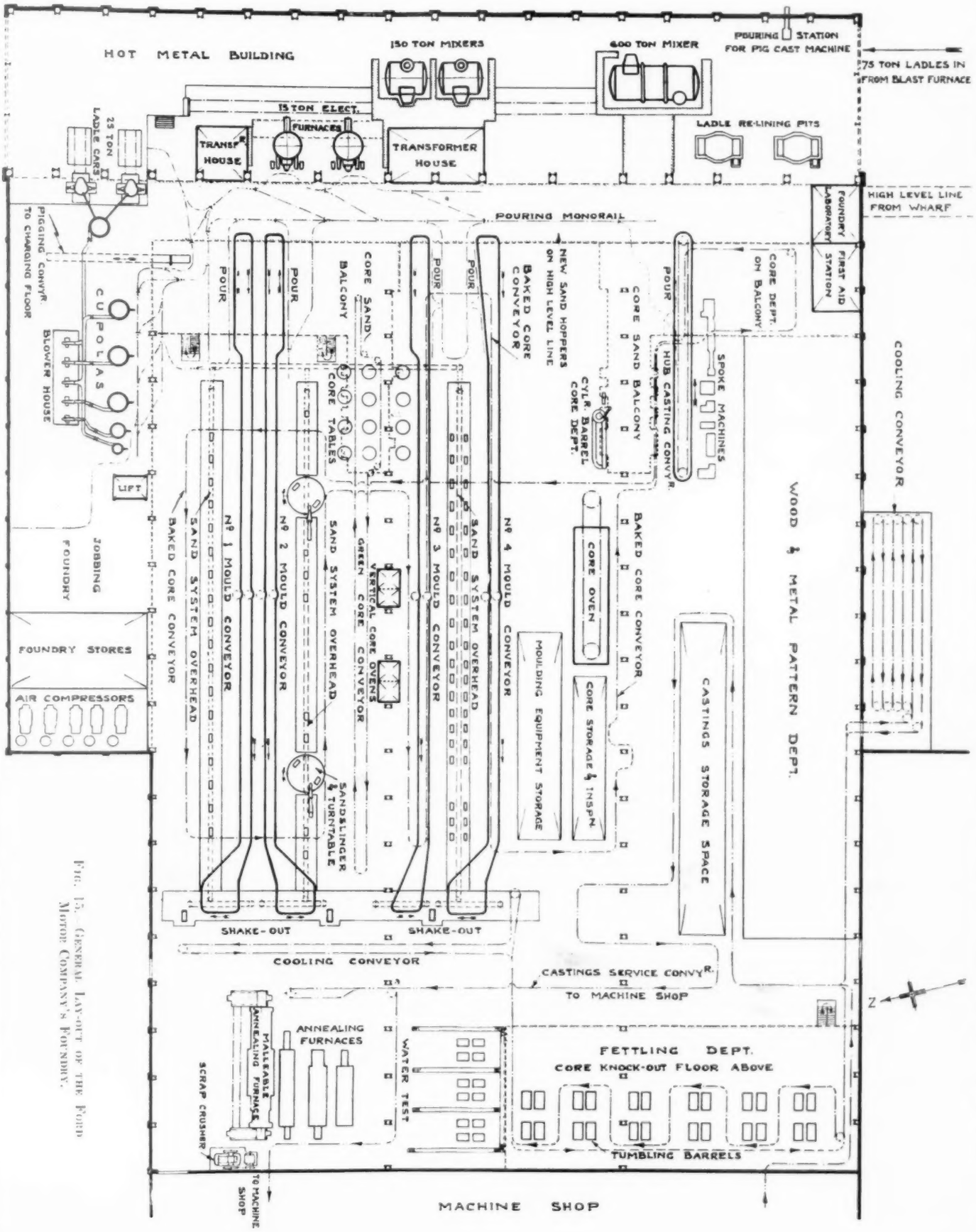


FIG. 13. GENERAL LAY-OUT OF THE FORD MOTOR COMPANY'S FOUNDRY.

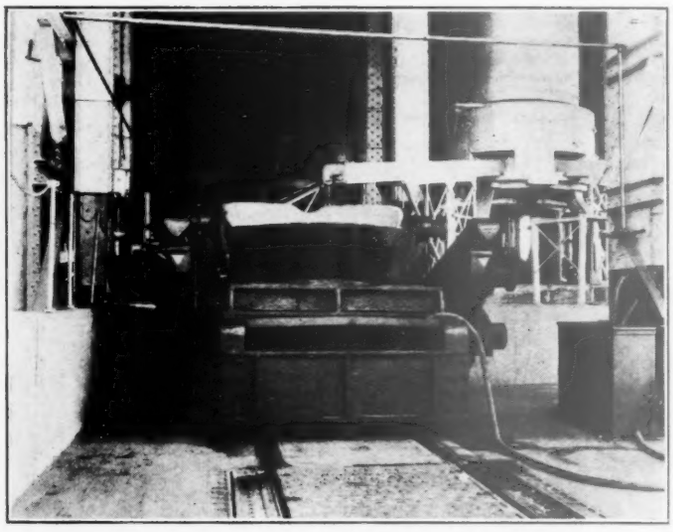


Fig. 8.—The Hot-Metal Shop Cupola Melting Plant and Scale Car.

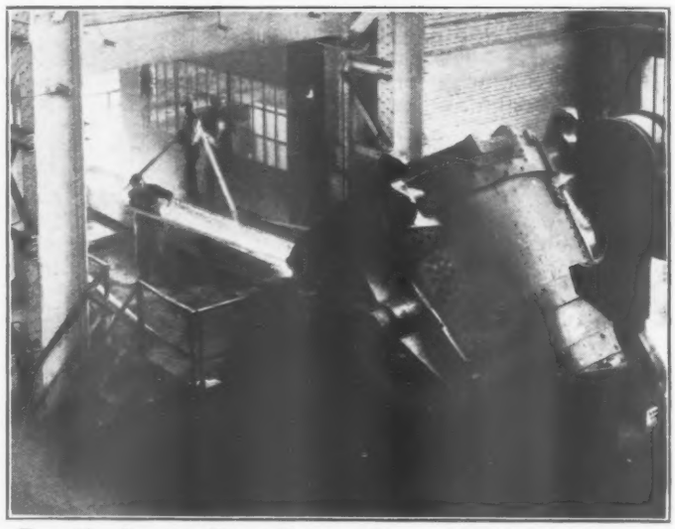


Fig. 11.—Straight-Blast Furnace Iron is Poured from 75-ton Ladles down this Shute, which Terminates in a Pig-casting Machine (Fig. 12).

Fig. 9.—Ladle Car being Weighed. It is used for taking a Mixture of Cupola and Mixer Metal to the Electric Furnace.

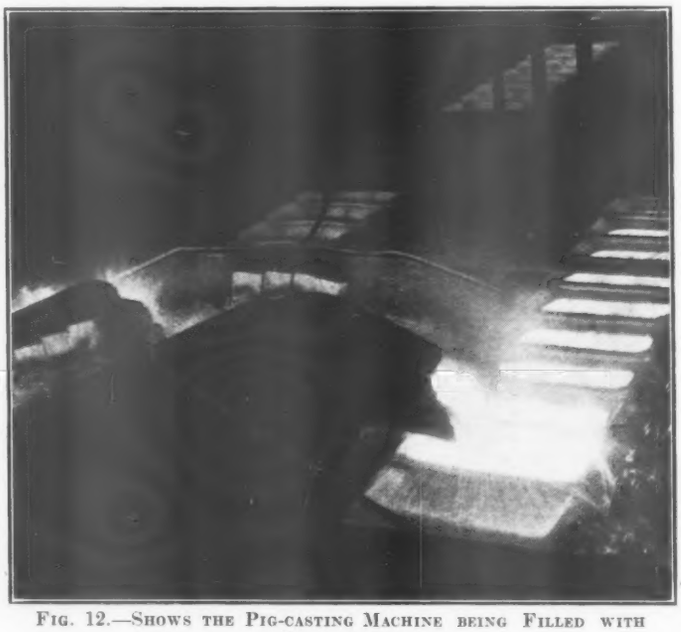


Fig. 12.—Shows the Pig-casting Machine being Filled with Liquid Iron.

Fig. 10.—Two 15-ton Electric Furnaces are provided for Superheating the Metal.

Fig. 13.—The Pig-casting Machine empties direct into 50-ton Steel Trucks.

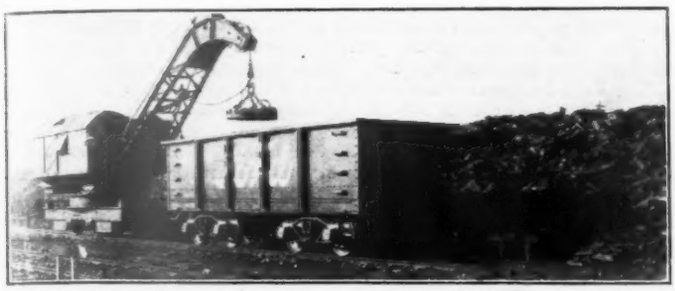


Fig. 14.—The Iron is discharged by Magnet Crane into Segregated Areas of the Stock Yard.

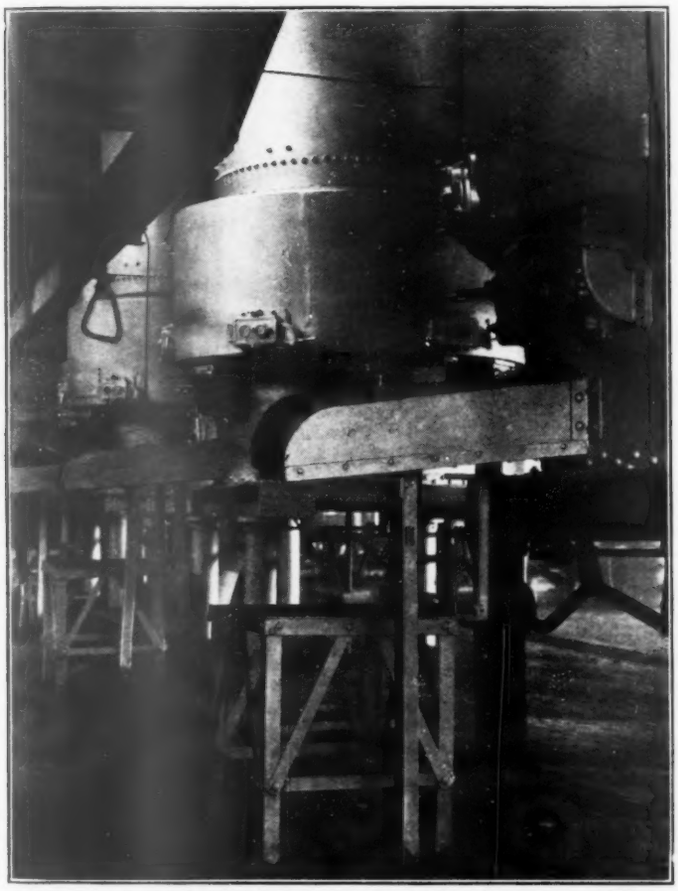


Fig. 16.—The Melting Plant comprises Five Cupolas of a Total of 37 to 40 Tons per Hour.

Fig. 17.—Pig-casting Machine for taking Over-Metal back to the Cupola Stage.

Fig. 18.—A New Type of Coke-Oven-Gas fired, Rotary Furnace is used for Melting Malleable Iron.

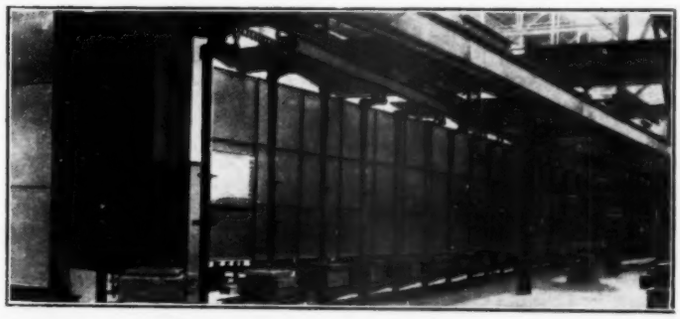


Fig. 19.—The Pendulum Mould Conveyor of No. 1 Moulding System.

Fig. 20.—Shows the Tray Conveyor Feeding No. 1 System with Cores and the Slat Conveyor for returning Boxes.

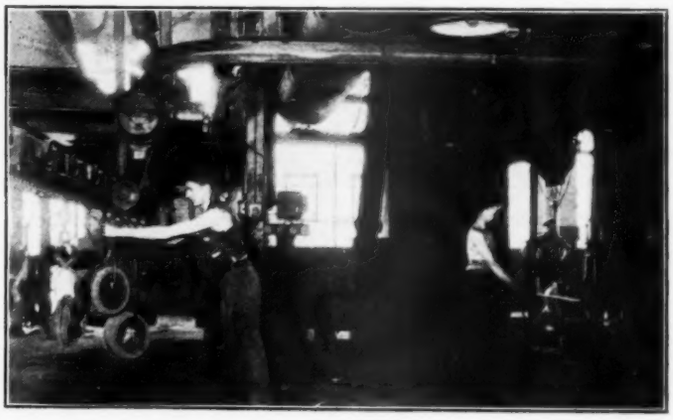


Fig. 21.—The Knock-out consists merely of a Grating beneath which is a Belt Conveyor. The Castings are here attached to a Chain Conveyor.

XUM

foundry is housed at the blast-furnace end of the general buildings and, including patternmaking and fettling, occupies an area of 130,500 sq. ft. At the time of writing about 800 men were employed in the foundry services, whilst about 5,000 h.p. is available for its operation. As will be seen from the general lay-out plan (Fig. 15), the moulding units receive liquid metal at a point near the cupolas, whilst the shake-outs are positioned adjacent to the fettling shop. One

Fig. 22.—This Vibrating Screen has beneath it a Row of Bunsen Burners for Eliminating Accumulations of Paper.

core department is placed between moulding units 2 and 3, whilst the second is placed between moulding systems and the patternshop. An elevated reversible belt conveyor, to be dealt with later, and spanning all the moulding units working in conjunction with a belt conveyor from hopper on the high line, supplies new sand for moulding. The five moulding units are occupied as follow:—No. 1 system, which is nearest to the melting plant, makes the heavy tractor parts; No. 2 takes care of the cylinder blocks; No. 3 is engaged upon transmission cases and flywheels; No. 4 tackles the light, small castings; whilst No. 5 is purely engaged upon the manufacture of tractor rear wheels, "spiders," which are a composite aggregation of steel strip spokes with a cast-iron boss.

Melting Plant

The melting plant (Fig. 16) consists of three 78-in. dia. cupolas (not counting one of this diameter which is in the hot-metal shop for operation in conjunction with the metal mixers and electric furnaces), one 51 in. and one 36 in. These cupolas, which yield 10 to 12, 5 to 6 and 1 to 2 tons an hour respectively, have two rows of tuyeres in each cupola with its charging door 18 ft. 3 in. above the bottom doors. The blast to each individual cupola is controlled by an automatically-controlled blast gate, a full description[2] of which has been previously published, is delivered by five centrifugal blower fans, the output of four of these being 5,300 cub. ft. per min. each, and the fifth 1,000 cub. ft. per min. at 1½ lbs. pressure. The largest cupolas consume about 435 lbs. of air per min. and the smallest 87 lbs. per min. As is usual in the automobile industry, the cupolas are hand-charged, the control system being similar to that described by O'Sullivan.[3] The cupolas are repaired with a proprietary plastic refractory and the consumption is 45 lbs. per ton of metal melted. The metal is transferred by 10-cwt. monorail-suspended ladles for direct feeding Nos. 1 and 2 moulding units, and subsequently transferred to 56-lb. hand shanks for the lighter castings made on No. 3 and No. 4 conveyors and also for certain jobs on No. 1 conveyor. From the pouring stations there is a conveyor, which is virtually a pig-casting machine (Fig. 17), to return all dull or over-metal back to the charging floor.

The pans of this conveyor are automatically sprayed with limewash to prevent sticking, the wash being dried by a series of coke-oven-gas burners playing upon them as they pass by. The conveyor is 62 ft. long between centre line of sprockets and requires 5 h.p. for its operation. In addition to the cupola plant there has recently been installed a 5-ton capacity rotary coke-oven gas-fired furnace (Fig. 18) for melting malleable iron. As this is probably the first of its kind in Europe, its performance will be a matter of considerable interest to the metallurgical world. At the time of writing, melts of uniform analysis are being obtained in about 1¾ hrs. and a further half hour is allowed for bath-sampling results and super-heating. The melting losses of silicon and manganese compare very favourably with those obtained in the usual pulverised-coal or oil-fired types of furnace.

No. 1 Moulding System

This system, as shown in the lay-out plan in Fig. 15, is adjacent to the melting plant. It comprises a line of 19 moulding machines, served by an overhead supply of both facing and backing sand, a pendulum conveyor (Fig. 19) for taking away the moulds, a tray conveyor (Fig. 20) for bringing up the cores and a slat conveyor for returning certain of the boxes from the shake-out. It shares with No. 2 system a cooling tunnel, located between the two systems. The shake-out (Fig. 21) which provides, of course, the main source of the sand supply, is merely a grating. The heavier moulds are lifted off by an electric hoist, the boxes being returned either by the pendulum conveyor or the slat conveyor (Fig. 20), whilst the casting is attached to a chain conveyor for cooling prior to transference to the fettling shop. The sand falls on to a heat-resisting belt conveyor 30 in. wide—which also receives all the spillage from the moulding machines, which is returned by means of an underground 24-in. belt conveyor running at right-angles to it. This shake-out belt conveyor feeds a 65-ft. high bucket elevator mounted on a chain belt. Each bucket measures 14 in. by 7 in. by 7½ in. deep, and the elevator runs at a speed of 250 ft. per min. Experience has shown that for foundry-sand handling it is preferable to move small quantities quickly, rather than large amounts slowly. The bucket elevator discharges on to a belt conveyor terminating in a magnetic pulley for the removal of any tramp iron which is discharged down a shute, whilst the sand passes through a vibrating screen (Fig. 22). As is well known, Ford's is as clean as any plant in Great Britain, yet it has been found desirable to fix at the end of this screen a row of Bunsen burners for igniting the accumulation of paper cartons which takes place. The discharge from the screen enters a continuous paddle mixer designed to deal with 50 tons of sand per hr., but is capable of doubling this output. After this treatment the sand passes through an aerator of the type which throws the sand at high speed through a series of suspended bars. This contrivance is hinged at its base and is caused to rise through the operation of a cam action and fall by gravity. This jarring is necessary to free the suspended bars from accumulating sand. The aerated sand is discharged directly on to a belt conveyor feeding the mould hoppers. Adjustable ploughs, which are merely hinged bars, regulate the supply to each hopper. A view showing this arrangement is given in Fig. 23.

(To be concluded.)

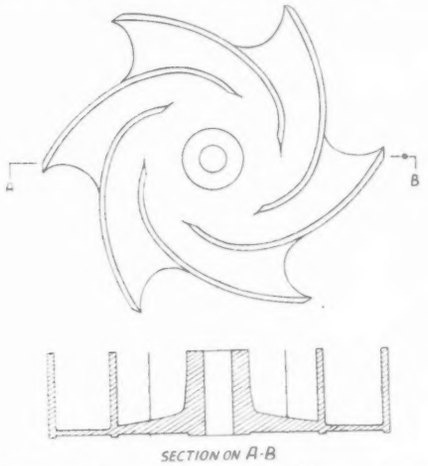
Fig. 23.—The Belt Conveyor supplying the Backing Sand to No. 1 System. The Hoods and Pipe shown are Part of the Ventilating System of the Mould-cooling Arrangements.

[2] "Constant Weight Cupola Blowers," Foundry Trade Journal, Vol. 27, p. 249.
[3] "Quantity Production of Grey Iron Castings," Foundry Trade Journal, Vol. 46, pp. 250, *et seq.*

Foundry Query

CHILLED IMPELLER VANES

As regular subscribers to your paper, we write to ask you whether you would kindly let us have your suggestions as to the best way of making small castings like the enclosed impeller easily machinable. We find the tips of the vanes too hard to machine. We have tried various methods



Impeller Casting Exhibiting Unmachinable Vanes.

of overcoming the difficulty, for example, by thoroughly drying the moulds and also by casting a large ring round the periphery of the tips so that it cools more slowly, but we have not been successful.

Any suggestions you can make will be acceptable.—PUMP.

A Note on the History of the Development of Ironfounding in the Sheffield District

By J. E. Hurst

(*Concluded from page* 220.)

It appears probable that the widespread development of sand moulding as distinct from loam moulding did not commence in this country until the end of the seventeenth century. The increased facility afforded by the introduction of sand-moulding methods in the production of all sorts of designs and shapes of castings probably played a far greater part than is usually understood in the rapid development of ironfounding which began about this period. Experimental work in the casting of all sorts of articles in cast iron was indulged in throughout the country. In the "History of Furness" (Fell) it is recorded that prior to 1721, boilers, kettles, pans and other articles were brought in large quantities by the Backbarrow Company for distribution in the district, probably in part manufactured by Abraham Darby, who had by this time established himself in Bristol and was operating his sand-moulding methods. The Backbarrow Company ultimately started in this business

Fig. 5.—George Newton. Original Partner in Newton, Chambers & Company, Limited.

Ex Habershon, "Chapeltown Researches," by permission of the Chief Librarian, Sheffield.

themselves, and it is recorded that they employed Isaac Wilkinson as "pot founder," who came to Backbarrow about 1740. Here he developed the moulding of box smoothing irons, firegrates, heaters, hatters' basins and Guinea kettles, named after the country in which they were used, and probably the almost spherically-bodied kettles of the type still familiar.

Enterprise of the Walker Family

In the Sheffield district the development of ironfounding took place at a date equally as early, if not earlier, than in other parts of the country. The fragmentary records of the casting of cannon by the Copleys at the Chapeltown furnace indicate that cannon were cast here during the Civil War (1642-46). The wave of development in ironfounding in the Sheffield district attracted the attention of the Walkers whose business, founded on the early moulding and casting experiments of Aaron Walker, became one of the most prominent ironfounding enterprises in the district and the origin of the further extensive development of ironfounding in Sheffield. In Hunter's "Hallamshire," Samuel Walker is credited as being the founder of the iron trade in these parts. The Walker family originated from Grenoside, where Samuel Walker, the outstanding personality in the subsequent development of the Walker enterprise, was the second of three brothers and four sisters who were left orphans when he was about twelve years of age. Samuel qualified for keeping school at Grenoside, where prior to 1746 he taught reading and writing. His mechanical turn of mind showed itself in his spare time, which was occupied in making mechanical contrivances and particularly sundials—some of which are still extant.

In 1741 his brother Aaron, associated with John Cranshaw, carried out experiments in the making of cast-iron shoe buckles. It is recorded that these early experiments were tried out in Abraham Booth's smithy at Oughty Bridge, but were unsuccessful. In or about 1741 Aaron and Samuel continued their experiments in an old nailer's smithy at the back of Samuel's cottage at Grenoside. The business thus commenced apparently prospered, and Samuel gave up his teaching activities in 1745 to devote his attention to the continued expansion of the business. With this continued prosperity they transferred their activity to Masborough, where a casting house, two air furnaces and a smithy were erected in 1746.

Invention of the Cupola by William Wilkinson

It is of some interest to refer to the record of the establishment of air furnaces. It is probably correct to assume that the air furnaces referred to are similar in type to the furnaces described by the same appellation to-day—otherwise reverberating furnaces. For the most part in those times castings were produced from molten metal direct from the blast furnaces, and the blast-furnace plants were also the main foundries. For example, Isaac Wilkinson worked in his foundry at Backbarrow, and it is recorded that ladles of molten metal from the furnaces were drawn across the road by horses. The hearth-type air furnace appears to have been adopted as a means of remelting, but with the development of casting production the cupola was devised by William Wilkinson—John's brother—an obvious extension of the principle of the blast furnace to the remelting of pig-iron. It can be conjectured that the increased facility afforded by the cupola in providing molten iron was also a very potent factor in the rapid development of foundry plants independent of blast furnaces which sprang up at this time.

"In addition to castings in iron and brass, the Walkers made, and in fact specialised in, steel produced by the crucible process. This had been recently invented by Benjamin Hunstman, and the knowledge of the process, it is said, had been gained by Samuel Walker through the meanest of imaginable ruses. (Santes Industrial Biography, Ch. VII.) A steel furnace, evidently of the cementation type, was built in 1748, the first crucible furnace set up in the following year and several others of both kinds were added, both at Rotherham and Grenoside. In 1754 a forge was built, and in May, 1759, the Walkers and Crawshaw obtained from the Earl of Eppingham a lease of an old smithy mill on the Holme Goit, a waterway connected with the River Don." Precise details of the growth of the Walker enterprise are reproduced in facsimile by Guest, the Rotherham historian, from the pocket book of Samuel Walker. The production of castings for the year 1741 to 1742 was 5 tons. In the year "ending 1746, the date of the establishment of the Masborough establishment, the production for the year was 63½ tons, and in the next ten years this had grown to over 300 tons. In 1766 the output of castings was 622 tons, but the greatest development comes later when the company, through the good offices of the Marquis of Rockingham, obtained lucrative contracts for ordnance. During both the American War and the later war with France cannon were produced on a large scale; in 1781, for example, 1,221 tons, three-fifths of the total metal cast by the firm were supplied to the Government."

The Crawshaws along with the Walker Bros. continued in business together until 1789, when the Crawshaws withdrew from the business. The Walker enterprise expanded to one of great magnitude, and part of the wealth accumulated by the partners was applied in other directions. A little later than 1778 Samuel Walker participated in the establishment of the banking house of Walker, Eyre & Stanley, of Sheffield and Rotherham, and the Crawshaws were amongst the original shareholders of the Company of Proprietors of the Navigation of the River Don.

Tom Paine at Masborough

With the close of the Peninsula War in 1815, Walker Bros. in common with others of the iron industry throughout the country suffered through loss of ordnance contracts and turned their attention to other activities. In this direction the application of cast iron to the building of bridges became one of the main occupations of the ironmaster. At this period the Walkers undertook to cast the Southwark Bridge. In bridge-building they had associated with the somewhat erratic genius, Tom Paine. After the

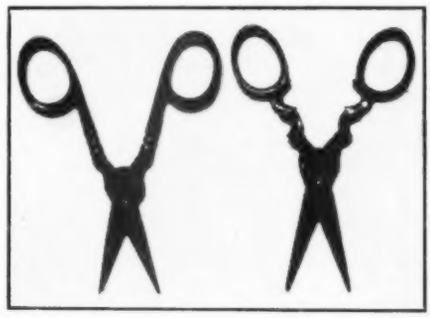


Fig. 6.—Cast "Malleable Cast Iron" Scissors.

By the kindness of Capt. R. G. Burnell.

conclusion of the American War, in the prosecution of which he took a prominent part, he turned his attention to civil engineering. Round about 1786 he exhibited models of bridges before the Academy of Science in Paris and the Royal Society in London. In 1788 he obtained a patent for his design, and arrangements were made with the Walkers, who set aside a room at Masborough where Paine was free to make his drawings and erect his toy bridges. It was at Masborough that an arch of 90 ft. was constructed to span the River Don and another of 110 ft. was removed by sea and exhibited to the public at Paddington. From a modification of his designs the bridge over the Wear at Sunderland and the bridge at Yarm were erected by Walkers in 1796. Tom Paine left the seclusion of his office at Masborough to take part in the French Revolution. As a friend of Lafayette's he was entrusted with the task of forwarding the key of the fallen Bastille to Washington. It was sent in May, 1790, along with half-a-dozen razors made from Walker's cast steel.

Casting the Southwark Bridge

Designed by Rennie, the casting of the Southwark Bridge at the time was looked upon as the great wonder of the day. The centre arch was erected at the Holmes works and vast crowds went to see it. The financial arrangements of the Southwark Bridge project proved a failure, and this led to the ultimate disintegration of the Walker enterprise. The undertaking was

of so great a magnitude that assistance was sought from other ironworks, and sub-contracts were allocated to the firm of Newton, Chambers & Company, Limited.

It was at the Walker works at Masborough that Thomas Chambers, partner of George Newton in the large Thorncliffe Ironworks, received his early training. It is recorded that he left Walkers owing to a dispute in the patternshop about the infliction of a fine of one shilling for breaking a tool, and he joined the company of Messrs. Smith, Stacy & Company, of Queen's Foundry, Paradise Square, at the corner of Queen Street, and Workhouse Croft, evidently another ironfoundry which had been established in the Sheffield district during this period. In the year 1792 Thomas Chambers entered into a partnership with George Newton, a manufacturer of spades and trowels in Sheffield, and in December of that year the Phœnix Foundry was established, where articles such as stoves, wheels and machinery for the cotton mills, which were rapidly coming into being, were manufactured. The partnership rapidly proved successful, and finding difficulty in obtaining supplies of pig-iron, they determined to set up smelting works of their own. A lease of land, coal and ironstone was arranged with the Earl Fitzwilliam, and the Thorncliffe Ironworks at Chapeltown came into being. The first furnace was put into blast in 1795, and seven years later the foundry was moved from Sheffield to Chapeltown. The foundry was occupied with the production of general iron castings.

Prices of Castings in 1807

Habershon has given us a record of the prices of various castings on January 1, 1807, which is of general interest to-day—

Wheelbarrow wheels	18s. 8d. per cwt.
Anvils	14s. to 16s. 4d. per cwt.
Sad irons	23s. 4d. per cwt.
Cash weights and block weights ...	14s. per cwt.

Six months' credit was given, and the prices were subject to a 5 per cent. discount for prompt cash. Some idea of the size of casting undertaken is to be had from the record of the terrible accident which occurred on July 19, 1820. The event occurred during a thunderstorm, when men were engaged on casting a shaft for Messrs. Armitage, Mousehole Forge, Sheffield. The shaft was 18 ft. 9 in. long and 16 in. dia., octagonal, weighing about 5 tons. The casting was being poured in a 15-ft. deep pit, when a terrific explosion occurred, during which Mr. Newton's son, Isaac, and eight workmen lost their lives.

Mr. James Malam, who had been connected with Messrs. Boulton & Watt, formed the firm and introduced the manufacture of gasworks plant. The firm has continuously played an important part in this branch of the industry, and in those early days supplied plant for the gas lighting of London, Brighton, Yarmouth, Hamburg, Reja and other large cities. In 1841, Newton Chambers had a contract for supplying castings for the construction of an iron lighthouse on Goodwin Sands, to the design and patents of Mr. William Bush, civil engineer. It was to consist of hollow segmental cylinder castings bolted together, with a circular staircase inside. Work was started on this, but was abandoned by Trinity House after a storm had destroyed the initial work.

The Age of Steam

The early part of the nineteenth century, after the close of the Peninsula War, witnessed the remarkable development in the application of cast iron. The introduction of the steam engine itself led to a great demand for foundry products, and this was especially marked after the year 1800, when Watts' patent expired, and it became possible for other firms to manufacture engines for sale. To Rennie belongs the credit for the introduction of cast-iron wheels and shafts, and after this cast iron was extensively substituted for wood and other materials which had been in use for this purpose. The application of steam power to the textile trades not only provided orders for iron smelting and casting firms, but brought into being specialised foundries in the main cotton and woollen centres about this time, for example, Hannah Lees & Sons, Ashton-under-Lyne, 1785; Dobson & Barlow and Samuel Lees, Oldham, 1790. Messrs. Newton Chambers & Company supplied castings to cotton mills in large quantities. These developments followed upon the introduction of sand moulding as distinct from loam moulding, and "the rapid developments in the application of iron castings led to many minor improvements, the accumulated effects of which were

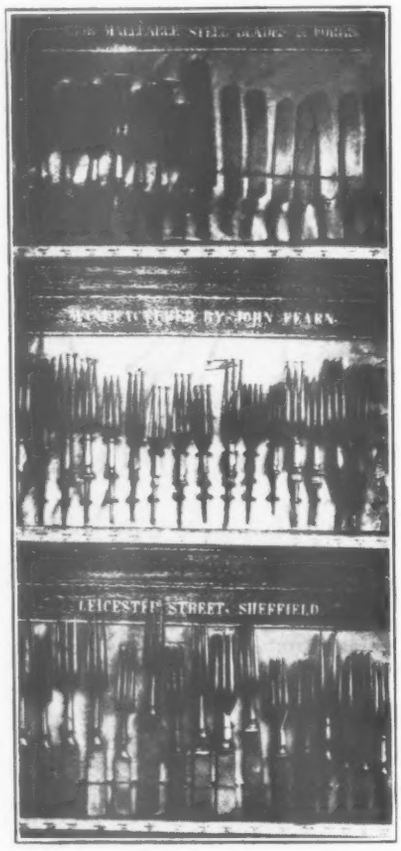


FIG. 7.—CAST "MALLEABLE CAST IRON" KNIVES AND FORKS.

By the kindness of Capt. R. G. Burnell.

almost as great as those which had resulted from the more spectacular development of the rolling mill."*

In these improvements in founding practice the early ironfounders of the Sheffield district must have played a leading part, for Sheffield became the centre of the production of art and ornamental castings, a branch of the industry which obviously demands perfection in moulding technique. Sheffield's pre-eminence in the production of high-class artistic ironwork has been attributed to the designs of the great Alfred Stevens, who was employed for years at the Green Lane works of the late Messrs. H. G. Hoole & Company. This cannot be the sole reason, and some credit must be attributed to the accumulated development of skill and foundry technique in the district. Alfred Stevens was assisted during part of his time by the little-less-known Godfrey Sykes.

In the Journals of the Institute of British Foundrymen, Session 1910-11, there is a very comprehensive Paper by Mr. W. F. Bagnall on the subject of art and ornamental castings, where descriptions and illustrations of many of the examples of the work of Sheffield and Rotherham foundries are given. Amongst the outstanding examples are castings by Messrs. Henry Hoole & Company and Messrs. Newton Chambers & Company. Amongst others of the ironfounders engaged in this class of work are the names of Messrs. Car Bros. & Webster, Sylvester Street, who are referred to in the Illustrated Guide to Sheffield, 1879, as using an ingenious system of coring to combine lightness and strength, Messrs. Steel & Garland, Wharncliffe Works, Green Lane, Messrs. Stuart & Smith, Messrs. Longden & Company, Messrs. Marshall, Watson & Morwood (whose patent Haleston stove had considerable reputation), Messrs. Hallersley Bros. Swinton, Messrs. Wm. Owen, Janken & Company, Rotherham, Messrs. W. G. Skelton & Company, Messrs. J. C. & J. S. Ellis, Messrs. W. Green & Company, and Messrs. Hayne & Company. These alone present quite a formidable list and are sufficient to indicate the extensive development of ironfounding in Sheffield after the middle of the nineteenth century. Sheffield ironfounders were represented at the Great Crystal Palace Exhibition in 1851. The firegrates exhibited by them were considered the very latest thing, and the work of Messrs. Hoole and Messrs. Stuart & Smith, to the designs of Alfred Stevens, won the unstinted praise of the jury. Messrs. Jobson & Company exhibited a patent heat- and light-reflecting stove.

Sheffield's Connection with the Carron Ironworks

Even the famous Carron Ironworks owe a great measure of their prosperity to the enterprise of a Sheffield man in the shape of Dr. John Roebuck. Born in 1718, John Roebuck was the son of a Sheffield manufacturer, and was trained in medicine at Edinburgh and Leydon. About 1740 he was established in practice in Birmingham, and he occupied himself with metallurgical studies, particularly with gold refining. Roebuck, in partnership with Samuel Garbett, set up a refinery in Steelhouse Lane, Birmingham, and a second establishment at Prestonpans, near Edinburgh. In 1759 the two partners, in association with William Cadell, a local ironmaster, set up the Carron Ironworks. Dr. Roebuck eventually met with financial troubles. His brother, Benjamin Roebuck, established the first banking house in Sheffield, and although there is no evidence that Dr. Roebuck took an active part in the management, it is believed that the closing of the bank in 1778 was not unconnected with the financial difficulties of the ironmaster.

So enthusiastic were the ironfounders of this time that they did not hesitate to extend their developments of the application of iron castings into the realm of cutlery. This caused the cutlery trade great concern. Prohibition of the manufacture of table forks from cast iron was attempted by law as early as 1780, and it was said at the time that these brittle goods could yet be turned out so successfully as to imitate forged steel and many of the best houses in the trade were engaged in their production. The steel-fork trade as an occupation was rendered highly precarious by reason of the competition of cast iron, even before the introduction of white metal. In an address by the Master Cutler of 1797, which was printed in the "Sheffield Iris" of November 17 of that year, dealing with the subject, he referred to knives, razors, scissors and forks in cast or pig-iron. The cutlery trade was continuously concerned with this competition, and in 1819 (59 Geo. III) an Act to regulate the cutlery trade in England was passed. By this Act the device of a hammer to distinguish forged goods was created, and it was made penal to mark goods with a false description.

Development of Malleable Cast Iron

This, of course, cannot by any stretch of imagination be regarded as a praiseworthy step in the

* "Ashton," p. 103.

development of the applications of cast iron in the Sheffield district, and it is referred to here as illustrating the extent to which our early ironfounders were able to push their developments. It is also, to the author's mind, a very important circumstance in the consideration of the development of the malleable cast-iron industry in this district. It is, of course, well known that Reammer in 1722, in his treatise *L'Art d'adoucir le Fer Fondet*, described the process of softening cast iron by the heating of cast-iron castings for a sufficient length of time embedded in red oxide of iron. This is the essential feature of one of the modern processes for the production of malleable castings, generally known as white-heart malleable castings, and the process is also spoken of as the Reammer or Old English process. The production of malleable cast-iron castings is now quite a substantial section of the ironfounding industry throughout the world, and the invention of this process may rightly be considered to rank in industrial importance with many of the inventions in steel metallurgy. The invention of this process is often ascribed to Samuel Lucas, of Dronfield, and, although the evidence is clear as to the earlier invention of Reammer, there is no evidence of the process having been practised in this country until the invention of Samuel Lucas for which he was granted a patent No. 2767, May 30, 1804. It is evident from the records of an earlier patent of Lucas (No. 1865, A.D. 1792), referring to the making of steel by heating together rich ore and charcoal in pots, that he was occupied with experiments of this nature, and it is a legitimate conclusion to draw that his patent relating to the malleablisation of cast iron was the result of independent experiment.

Commercial Production of Cast-Iron Cutlery

In the Lucas patent which is entitled "Separating impurities from cast iron without fusing it and rendering the same malleable and improving articles made of cast iron," the articles of cast iron are cemented five or six days and nights in a steel-converting or other suitable furnace with ironstone ore or some metallic oxides, lime or any combination of these. Cylindrical cast-iron pots are commonly used for this purpose. According to the account in Percy's "Metallurgy," it is stated that on account of difficulties at the time believed to be insuperable, no use was made of the patent for a considerable time after it was granted, until Mr. Thomas Lucas, of Chesterfield, with the consent of his brother, the patentee, took up the process and succeeded by its means in producing cast cutlery, which, according to Parkes,* would take as fine a polish and as fine an edge as articles of the best cast steel. It is asserted on the authority of another writer that Lucas's invention "was presently turned to a large practical account, and the variety of new and useful purposes to which it might be applied were soon found to include the casting of all sorts of cutlery articles and edge tools from the largest to the smallest with utmost facility."

From that time to the present moment (1831) immense quantities of wares, bearing in the trade the equivocal designation "run steel" have been daily cast and treated on the principle of the aforementioned discovery; without, however, undergoing any alternative process whatever between the blast furnace and the melting pot. The metal commonly used for this purpose is the sort drawn from the rich Cumberland ores. The cast articles were placed in cast-iron tubs which were filled up with either ground red hematite or more generally smeltes scales (smithy slack). Such was the malleability communicated to the cast iron, that the author has seen it drawn out by hammering to the fineness of a knitting needle. The process is still largely employed in Birmingham for bridle bits, stirrups, etc., and the usual selling price is 3d. or 4d. per lb.

Through the kindness of Capt. R. G. Burnell, the author was able to include an illustration of a group of rough-cast forks and knives manufactured by John Fearn, of Leicester Street, Sheffield. This, together with the illustration of a pair of cast scissors, shows clearly that this art of casting cutlery had reached a stage of development which has not been surpassed. The cast forks are described as malleable steel and actually are malleabe cast-iron castings which have been superficially hardened through case-hardening by reheating in animal charcoal.

* "Essay on Edge Tools." Parkes Chemical Essays, 1815.

Sheffield the Pioneer of Alloy Cast Irons

Alloy cast irons are apt to be regarded as essentially a modern development. In the latter half of the nineteenth century, Robert Mushet acquired patent protection for tungsten alloy cast iron (Patent No. 100, 1859), manganese alloy cast iron and titanium alloy cast iron (Patent No. 2,646, 1859). In this latter patent, a method is described in which the titanium addition is made to the cast iron by forcing titanic acid through the tuyeres into the cupola

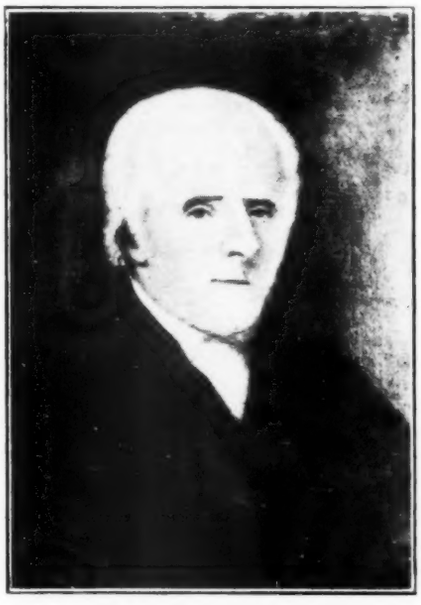


FIG. 8.—SAMUEL LUCAS, DRONFIELD, INVENTOR OF MALLEABLE CAST IRON, 1804.

By the kind permission of Geoffrey Lucas, Esq.

by means of an air blast. It is of especial interest to refer to Robert Mushet's Patent No. 646, dated 1863, describing a process for mixing cast iron with molten steel. This is one of the earliest patents in which the phrase semi-steel is mentioned. Through Robert Mushet, Sheffield is thus able to lay claim to the honour of pioneering the development of alloy cast irons.

From the latter half of the nineteenth century to the present day is comparatively recent history. Whilst the view is possible that in the Sheffield district, at any rate during this period, its early prominence in ironfounding has steadily become overshadowed by the rapid developments in the steel industry, the ironfounding industry still has a justifiable pride in its achievements.

Some of the foundries mentioned are still in existence, *e.g.*, Messrs. Newton Chambers & Company, Limited, and Messrs. Samuel Lucas, Limited, Dronfield. The Brightside Foundry Company, Limited, as a Sheffield ironfoundry is responsible for many of the largest castings in cast iron that have ever been made, and the more recent activities in the Sheffield district have been referred to already.

In closing this brief account of the history of ironfounding development in the Sheffield district, the author thanks the many friends who have kindly assisted him in providing information and references. Amongst these he would like to pay special tribute to their Reference Library and to the Chief Librarian for the generous assistance so freely given. Most of the illustrations have been copied from works in their possession.

Prices and Wages in the Iron and Steel Industries

RESULTS OF RECENT ASCERTAINMENTS

The following table, which is extracted from the "Ministry of Labour Gazette" for September, shows the results of recent ascertainments of selling prices of pig-iron and of manufactured iron and steel upon which are based changes in the rates of wages of certain classes of iron and steel and other workers in particular districts :—

Product and district.	Period covered by last audit.	Average selling price per ton, according to last audit.	Inc. (+) or Dec. (−) of last audit on	
			Previous audit.	A year ago.
		s. d.	s. d.	s. d.
Pig-iron :	1934.			
Cleveland ..	Apr.-June	55 2½	+ 1 2½	+ 4 6½
Cumberland .. (*Hematite mixed numbers*)	May-June	60 10½	+ 0 10½	− 2 2
Lincolnshire ..	Apr.-June	55 0½	+ 2 3½	+ 3 11
Nottinghamshire	Apr.-June	53 9½	+ 0 1½	+ 0 9½
North Staffordshire	Apr.-June	55 1½	+ 0 1½	+ 2 7½
Northamptonshire	Apr.-June	50 1½	+ 1 0½	+ 3 2½
West of Scotland	Apr.-June	62 10	+ 0 11	− 0 10
Manufactured Iron :				
North of England	May-June	170 3½	+ 2 9½	− 0 9½
West of Scotland (*Rounds, flats, squares, angles, hoops, tees and rods*)	May-June	190 11½	+ 2 1½	− 2 0½
Steel :				
South-West Wales (*Steel tin bars*)	Apr.-June	95 2½	+ 1 6½	+ 4 5

In accordance with the provisions of the agreements under which wages are regulated, the ascertainment for Northamptonshire resulted in an increase in the wages of blast-furnacemen, ironstone miners and quarrymen, and limestone quarrymen in that area.

In the case of blast-furnacemen in Cleveland and Durham, iron puddlers and millmen in the North of England, and iron puddlers and millmen and sheet millmen in the West of Scotland, the change in the ascertained price was insufficient to warrant a change in wages.

Increases warranted by the ascertainments in the wages of blast-furnacemen in West Cumberland and North Lancashire and in North Lincolnshire were not put into operation, as reductions due under previous ascertainments had been waived by the employers, while the wages of blast-furnacemen in North Staffordshire remained unaltered at a level higher than that warranted by the price ascertainment. There was also no change in the wages of blast-furnacemen in Nottinghamshire, where the employers agreed to continue the present rates of wages which have, since 1925, been consistently above the level warranted by the price ascertainments.

As regards blast-furnacemen in the West of Scotland and Siemens steel workers in South-West Wales, the reduction in price did not involve any reduction in wages, since the latter had already reached the minimum provided for in the agreement.

Iron and Steel Production

The British Iron and Steel Federation, in its "Statistical Bulletin" for August, states that the production both of pig-iron and steel in the United Kingdom declined in August due to holiday influences—pig-iron from 528,300 tons in July to 503,300 tons and steel from 718,200 tons to 667,000 tons. The number of blast furnaces in operation declined by two during the month to 97. According to returns received from 153 firms employing 118,901 workpeople, the average weekly earnings per head in July amounted to £3 1s. 6d., compared with £3 2s. 2d. in June and £3 0s. 11d. in May.

Porosity Chills and Denseners

A PRACTICAL DISCUSSION

Under the auspices of the West Riding of Yorkshire Branch of the Institute of British Foundrymen, at Bradford Technical College, Mr. E. Longden (Manchester) lectured, with the aid of lantern illustrations, on the subject of "Porosity." Mr. R. D. Welford (President of the Branch) presided. Much of Mr. Longden's work has since been embodied in a Paper which he presented on behalf of the Institute to the Association Technique de Fonderie.

Opening the discussion, Mr. W. G. Thornton (Bradford) said he had been greatly interested in the lecture, though a little surprised that Mr. Longden had made comparatively little mention of composition, rate of cooling, and the speed of casting. These, of course, were three main factors when discussing the problem of porosity. Mr. Longden had detailed a mixture in which he gave the quantity of 1 per cent. phosphorus, but surely that was inadvisable except for light builders' castings? In connection with a gas-engine-cylinder casting which had been mentioned and illustrated, Mr. Thornton said he felt better results might have been obtained with a runner all round the mould. Mr. Thornton said it would be interesting to hear if Mr. Longden had had any experience with what was commonly known as the pencil runner and what were his views upon it. In regard to the ganister-lined mould, how many castings could Mr. Longden usually get out of that type? Had he ever tried to produce more than one casting out of a mould for carding rollers?

Mr. A. W. Walker (Huddersfield) said, from the nature of the lecture, it would almost seem as though Mr. Longden made chills a matter of foundry practice rather than merely an occasional expedient, as was more usual among the Yorkshire foundrymen. Mr. Longden did not seem to think liquid shrinkage was the cause of trouble in the cases he had illustrated, but to his (Mr. Walker's) mind the evidence rather seemed to point to there being liquid shrinkage as well as gas inclusions.

Mr. A. S. Worcester (Huddersfield) said Mr. Longden made a point of regulating the size of his runners, but he (Mr. Worcester) was in agreement with Mr. Walker that it was questionable whether the cavity was due to gas holes or liquid shrinkage. One felt there must be an escape of gas from the point affected, or, on the other hand, was it the heating of the sand at local spots? In regard to the carding cylinder, a very thin casting, Mr. Worcester thought the trouble of porosity was often due to the metal not being sufficiently hot.

Chills and Defects

Mr. W. Fearnside (Keighley) asked whether Mr. Longden had ever experienced difficulty with gas caused by the denseners. He (the speaker) had found rather a tendency for gas holes to appear around the chills. A question arose also as to how many times a chill should be used to come into contact with the molten metal. It must surely be rather expensive to make chills to go all round a mould if it was only a one-off job.

Spacing of Denseners

Mr. F. K. Neath (Keighley) said the question as to whether denseners should be close together or should have some space between was one which was open to a good deal of questioning, and experience varied as to the extent to which one or the other method might have an effect in bringing about cracks in castings. One wondered whether Mr. Longden, in arranging his denseners all round the mould, had them actually face to face or left a little space to allow for expansion.

Mr. McColl (Bradford Technical College) raised the question of oxidation of the graphite. He wondered if, in Mr. Longden's methods, he got decarbonised areas anywhere in the casting.

Mr. J. Fearnside (Keighley) asked Mr. Longden what thickness of chill he recommended. Mr. Fearnside said he had heard it declared by some members of the industry that the heavier the casting, the heavier should be the chill. In regard to pencil runners, he felt these had to have a very clear course.

Metallised Cores

Mr. S. W. Anson (Leeds) asked whether Mr. Longden had had any experience of the type of denseners made from iron filings and oil sand, and, if so, what were the results?

Mr. W. Parker (Halifax) said, in his own experience, he had found chills on liners were apt to create drawn places on the face of the metal if aligned with the face of the mould. Referring to bottom runners in deep castings, Mr. Parker said he had not found much success with them. There was usually a film of scum, and he felt one was seeking trouble. His own belief was that nothing was better than a runner all round the job. As to shrinkage and porosity, it would be helpful to know whether Mr. Longden used a cheap iron to compensate for the cost of the chills? Mr. Parker said he had never had much success with putting chills on the top side of moulds.

Mr. S. Carter (Huddersfield), referring to the spacing of chills, remarked that in the case of the cylinder casting mentioned by the lecturer, if the chills were placed all round the job without spacing surely there would be a strain on the casting and that some spacing should be allowed to avoid that?

Mr. J. J. Watson (Huddersfield) asked was he correct in understanding from Mr. Longden that of the four different weights of castings the one which was sound was less dense than the others?

AUTHOR'S REPLY

Mr. Longden, replying, said, dealing first with Mr. McColl's question as to oxidation of the graphite, it was very probable one would get an open-grained structure, but he (the lecturer) had not had occasion to examine the matter in that respect so closely as perhaps Mr. McColl would have wished. In answer to Mr. Thornton on the rate of cooling and composition of metals, Mr. Longden said he gave in his address four or five analyses. Mr. Thornton suggested that 1 per cent. of phosphorus was ridiculous, but the fact remained that no matter what phosphorus content was used in these test blocks, commercially sound castings were secured. As to the rate of cooling, this was dependent on more conditions than the composition of the metal. In answer to questions as to chills all round the job, there was certainly gas left in the moulds, but with a complete set of denseners there was little left, and the only gas one might have to fear would be gas given out from chills or from the metal, and there was more trouble from overheated chills than from any lack of attention to rust or other neglect. In regard to pencil runners, Mr. Longden said he had certainly used them with advantage. With pencil runners one got a relatively hot temperature which would allow a better exit of the mould gases. On the question of ganister, the speaker said he was not attempting to produce semi-permanent moulds, but only desired to prove a case as to the soundness of casting from the hardest moulds. In answer to Mr. Walker and Mr. Worcester, Mr. Longden said one could not be sure of anything in metals, and probably, as those gentlemen suggested, there was some liquid shrinkage as well as gas holes. Liquid shrinkage did occur unless steps were taken to counter it; but his point in the address was that whilst it may not be possible to produce commercial castings in the way he had mentioned, he had indicated certain steps which could be taken to produce sound castings. In regard to the number of times one might use a densener, that was a matter largely dependent on how they were treated. The chief trouble of blowing from denseners arose from overheating. If one approached anything like 700 deg. C. one would probably get a blow. There should be as little metal flowing past the denseners as possible. On the matter of spaces between chills, this was certainly a difficult problem. The trouble was very real. If one kept an inch of sand between these heavy denseners one was likely to get a hair crack. If they were put close together one may get chills, and allowance must be made. Allowance was often made in the end of the bed. If the chills were closed up so one could not make up between them with fine sand, there was likely to be another form of crack on a hard white line. One could, he agreed, get cracks from them being too close and also from them being too wide apart. The use of iron filings and oil sand was quite common in some foundries. A better method, he felt, was to use steel shot and oil sand in varying percentages. Mr. Longden agreed that allowance must be made for expansion of the denseners. He agreed also with Mr. Parker that smaller ram cylinders were better poured from the top. In answer to Mr. Watson, the speaker said the variation in weight of the four blocks was due to a certain amount of chill expansion and one was certainly less dense than the others.

Vote of Thanks

Mr. A. W. Walker, proposing a vote of thanks, which Mr. S. W. Wise (Hon. Secretary) seconded, said one gathered from the address that there was a tendency towards a swing back to the use of chills. There were some in the industry who felt that the less they had of chills the better. Whilst admittedly chills had their uses under certain circumstances he (Mr. Wise) was of opinion that there was more danger from chills than without them.

Mr. Longden, responding, agreed that there was a danger of going too far in the application of chills. They should only be resorted to when other methods failed. Personally, he was quite open to accept any metal composition that would produce a casting to satisfy the modern demand and stand up to the rigid requirements of modern machine tools.

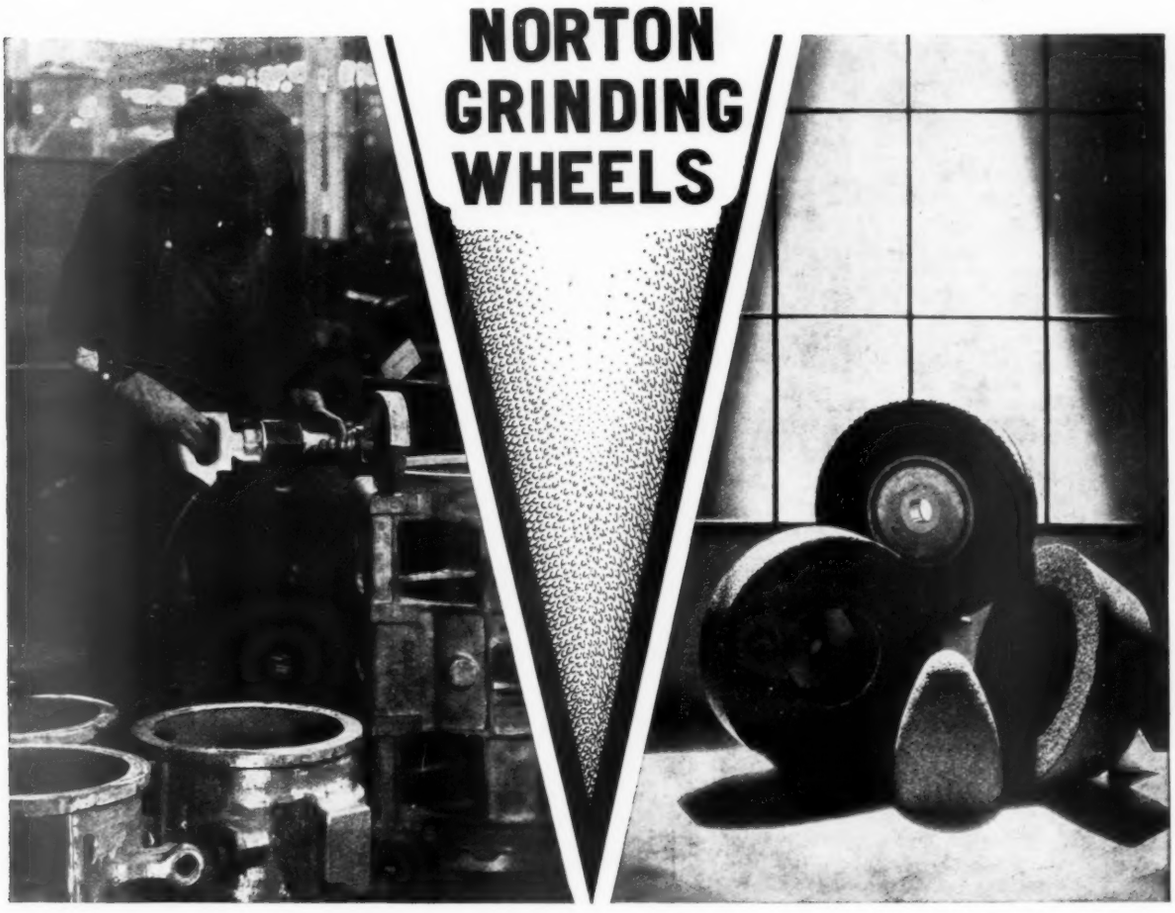
Iron and Steel Output in September

The British Iron and Steel Federation reports that there were 98 furnaces in blast at the end of September, compared with 97 at the beginning of the month, one furnace having ceased operations. Production of pig-iron in September amounted to 500,300 tons, compared with 503,300 tons in August last and 359,700 tons in September, 1933. The production included 129,400 tons of hematite, 245,700 tons of basic, 117,500 tons of foundry and forge pig-iron. The output of steel ingots and castings amounted to 734,700 tons, compared with 667,000 tons in August last and 669,000 tons in September, 1933.

Cast-Iron Road Surfaces

The University of Minnesota has obtained permission from the Minneapolis authorities to lay an experimental 30-ft. stretch of cast-iron blocks at the foot of a hill to test their durability and safety, as well as their convenience to traffic. Similar tests have been going on for some months past at Duisburg-Ruhrort, on the Rhine, where a number of road sections have been surfaced with different types of cast-iron blocks. These tests have up to the present proved very satisfactory and attracted the attention of various public authorities.

WHEELS THAT ARE READY AND WILLING TO WORK HARD.



MADE especially for portable grinders—made to work hard and fast. There are Bakelite bonded wheels for the newer high-speed machines and vitrified wheels for slow speed. There are cone wheels for the hard-to-get-at places.

The surfacing wheels have large, sturdy, threaded bushings moulded into them—ensuring a rigid, safe mounting and permitting the wheels to be worn to a surprisingly small stub.

Made in England by
NORTON GRINDING WHEEL CO., LTD.,
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Sales Representatives :
ALFRED HERBERT LIMITED,
COVENTRY.

XUM

This Week's News in Brief

Trade Talk

AN ORDER has been placed for a 300-ton steam yacht with Messrs. Scott & Sons, Limited, Bowling. She will be fitted with triple-expansion engines, oil-fired boilers and all modern improvements.

MR. H. WILLIAMSON, foundry foreman to the Singer Manufacturing Company, Clydebank, has been sent to the firm's new factory at Monza, Italy, to organise the work in the foundry there.

THE ADDRESS OF Berner Metals will in future be as follows:—Diantony Works, Anne Road, Birmingham, 21. Telephone: Smethwick 12789. Berner Metals have also formed a new company, the B.M. Rolling Mills, Limited, of the same address.

AS AN EXPERIMENT in construction and repair, a section of the Edinburgh road at Holytown has been laid with cast-iron plates. Two other parts have already been laid with these plates, and the result of the experiment is eagerly awaited at Shotts, where the plates were made.

MESSRS. JOHN BROWN & COMPANY, LIMITED, Clydebank, launched the destroyer H.M.S. "Foxhound," built under the 1932 programme. She has a displacement of 1,375 tons and propelling machinery developing 36,000 h.p., designed to give the vessel a speed of 35.5 knots.

MESSRS. SCOTTS SHIPBUILDING & ENGINEERING COMPANY, LIMITED, Greenock, and Messrs. William Denny & Bros., Limited, Dumbarton, have each received orders from the British Admiralty to build two destroyers under the 1934 programme. Both firms have just completed destroyers under 1931 programme.

MESSRS. D. & W. HENDERSON, LIMITED, launched from their Partick, Glasgow, yard the single-screw cargo steamer "Henzada," which has been built to the order of Messrs. Patrick Henderson & Company, Limited, managing owners of the Henderson Line. The vessel has a gross tonnage of 4,200, and has been built to the British Corporation's highest class.

FOLLOWING THE RECENT ANNOUNCEMENT that Messrs. Hurst, Nelson & Company, Limited, of Motherwell, had received an order for bogie-carriage underframes for India State Railways, comes news of another valuable contract secured by the same firm. This is stated to be for 500 railway wagons, with main-line brake equipment, for the L.M.S. Railway. The utmost secrecy is maintained, but the order is one of the most valuable of its kind to come to Motherwell for years. It is estimated that the value of the order is in the region of £500,000. This will keep the works going at top pressure for a considerable time.

"DIXON'S BLAZES," as the Govan ironworks of Messrs. William Dixon, Limited, are familiarly known, are to be largely extended and modernised. During the past year Messrs. Dixon made an offer to supply the Glasgow Corporation with large quantities of coke-oven gas at a low price, but in June last the Corporation refused the offer, together with a similar one from Messrs. William Baird & Company, Limited, of Coatbridge. In spite of this refusal, Messrs. Dixon have now decided to proceed with an important extension of their plant. A contract for the construction and erection of a large battery of coke ovens has been placed with Messrs. Simon-Carves, Limited, Manchester.

MR. DAVID FRAME, chairman and managing director of the Hammond Lane Foundry, Dublin, has become chairman of a new company having a factory at Bray, Co. Wicklow, for the manufacture of electric-light bulbs. It is understood that a capital of £50,000 will be called upon early next month. Mr. Frame and his fellow-promoters have, it is reported, put up one-half of the original capital. The development follows a recent announcement of a 75 per cent. tariff on bulbs, which is to take effect when the Irish products are available. The requirements of the Irish Free State are about two million bulbs a year, and it is stated that the new factory can comfortably cope with that demand.

IT IS ANNOUNCED that General Refractories, Limited, has just acquired the assets of Charles Bramall, Limited, Worrall, Sheffield. The property includes, quite close to Sheffield, large reserves of the well-known Sheffield ganister rock from which are made the best of the silica bricks used in the lining of the modern steel-melting furnaces—which work at such intense heats—together with substantial values in land, property, plant and machinery. Bramalls was one of the first works to produce the silica bricks which made large-scale production of steel possible, and remained in the control of the Bramall family for several generations. It is interesting to note that operations of the new owners will be carried on under the direction of Mr. George Bramall, a son of the late Mr. Charles Bramall, J.P., who was, in his time, a well-known Sheffield character.

A MEETING WAS HELD this week of shareholders of the Motherwell Waggon & Rolling Stock Company, Limited, which went into liquidation last year owing to the apparent impossibility of obtaining sufficient work to keep the establishment employed. The meeting was held to receive an interim report of the winding-up of the company. Mr. Thomas Ormiston, C.B.E., the official liquidator, in announcing a payment to shareholders of 10d. per £1 share, said that, although the liquidation had been a creditor's one, the final position showed that the company had been able to settle all its debts and have a balance of about £1,700. This had been due mainly to the better trade outlook, which allowed them to obtain better prices for their properties than they had anticipated a year ago. It was estimated that £7,200 would be obtained for their assets, and they had actually realised £13,000.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Martin Wyvill & Company, Limited.—Capital £500. Tool manufacturers and merchants. Subscriber: C. A. Elliott, 39, Bank Street, Sheffield.

Schori Metallising Process, Limited.—Capital £1,000. Directors: C. F. Lumb, Ballard Coombe, Coombe Warren, Kingston Hill; Florence Mallalieu.

Mersey Metal Industries, Limited, 8, Boundary Street, Liverpool, 5.—Capital £3,000. Ironfounders, mechanical engineers. Directors: J. Mackarell and J. D. H. Johnson.

Pressuretite, Limited, 46, Victoria Street, Westminster, S.W.1.—Capital £6,000. Ironfounders, manufacturers of machinery. Directors: F. D. Playford and G. R. G. Huddleston.

Cotal Chadburn Company, Limited, 9, Cloak Lane, Cannon Street, London, E.C.4.—Capital £20,000. Manufacturers of and dealers in engines, gears, locomotives, etc. Directors: J. Davie, W. R. Chadburn and R. N. Whitcomb.

Contracts Open

Bradford, October 29.—Iron and steel stores, for twelve months, for the Tramways Committee. The Tramways General Manager, 11, Forster Square, Bradford.

Colwyn Bay, October 22.—Cast-iron pipes and special fittings, for the Urban District Council. Mr. W. J. Dunning, engineer and surveyor, Town Hall, Colwyn Bay.

South Africa, November 22.—Turbo-alternator and water-tube boiler, for the Port Elizabeth Municipality. The Department of Overseas Trade. (Reference A.Y. 12,678.)

South Africa, November 9.—Motor-driven plate bending and straightening rolls, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference A.Y. 12,682.)

Company Reports

Sheffield Steel Products, Limited.—Profit on trading £39,438. After charging £9,063 for interest on bank overdraft, but before providing for debenture interest, there is a credit balance of £25,640, which reduces the debit brought in to £28,413.

Hurst, Nelson & Company, Limited.—Gross profit for year, £21,766; brought in, £25,191. After the payment of a final dividend on the 6 per cent. preference shares, and of a dividend of 9d. per share on the ordinary shares, £4,266 is carried forward (£4,650 having been placed in reserve).

Personal

MR. C. A. LLOYD, a local director of Messrs. Stewarts and Lloyds, Limited, Coombs Wood Tube Works, Halesowen, who has retired, has received a presentation from the staff of the works.

MR. F. GENTILES, who for the past fourteen years has been assistant foundry superintendent at the Renfrew works of Messrs. Babcock & Wilcox, Limited, has been appointed foundry manager to the Davis Gas Stove Company, Limited, Luton. Prior to joining Messrs. Babcock & Wilcox, Mr. Gentiles was in the employ of Messrs. Barr & Stroud, Limited, Glasgow, having previously been with Messrs. Lane & Girvan, Limited, Bonnybridge.

MR. ROBERT S. MILNE, of Aberdeen, who has been awarded the "Vickers Armstrong Scholarship" in naval architecture, has served an apprenticeship as draughtsman with Messrs. Hall Russell & Company, Limited, Aberdeen. He is a son of Mr. George Milne, Messrs. Hall Russell's shipyard manager, and was educated at Robert Gordon's College and the Technical College evening classes. He is now proceeding to Glasgow University for a four-year degree course.

Will

SMALLMAN, JOHN, formerly managing director of Hopyard Foundries, Limited, malleable ironfounders, of Coseley and Bilston, and lately in business on his own at Atlas Foundry, Walsall, as a manufacturer of malleable-iron castings £2,929

Obituary

MR. JAMES BROWN, who was for many years in the employment of Messrs. Walker, Hunter & Company, at Port Downie Iron Works, Camelon, died last week.

THE DEATH OCCURRED at Netherwood, St. Andrews, recently, of Mr. Alexander Douglas, at the age of 91. Mr. Douglas was for practically all his working life in the employ of Carron Company.

Forthcoming Events

Institute of British Foundrymen

OCTOBER 19.

Lancashire Branch (Junior Section):—Presidential Address, presentation of awards, and lecture on "Foundry Problems," at the College of Technology, Sackville Street, Manchester, at 7.30 p.m.

Sheffield and District Branch:—"The Testing of Steel-Foundry Sands and the Control of Supplies by Specification," Paper by T. R. Walker, B.A., at the Grand Hotel, Sheffield, at 7.45 p.m.

OCTOBER 20.

Scottish Branch (Falkirk Section):—Presidential Address, at the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

OCTOBER 26.

Middlesbrough Branch:—"Some Recent Developments in Foundry Melting Practice," Paper by H. Cowan, B.Sc., at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.45 p.m.

OCTOBER 27.

East Midlands Branch:—"Cupola Practice," Paper by L. W. Bolton, A.M.I.Mech.E., at the College of Technology, Leicester, at 6 p.m.

Newcastle-upon-Tyne District Branch:—"Grey-Iron Castings for Laundry Machinery," Paper by J. Longden, at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6.15 p.m.

Scottish Branch:—"Some Thoughts on Indian Foundry Production," Paper by W. T. Bruce, at the Heriot-Watt College, Chambers Street, Edinburgh, at 4 p.m.

Wales and Monmouth Branch:—"Oven-Drying of Cores and Moulds," Paper by E. G. Fiegehen, introduced by J. J. McClelland, at the University College, Newport Road, Cardiff, at 6.30 p.m.

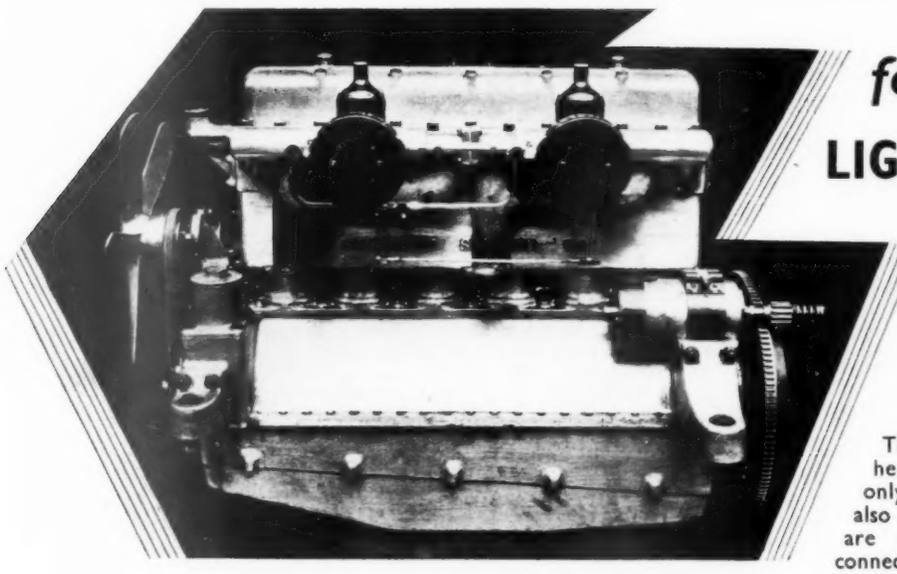
NOVEMBER 2.

Birmingham, Coventry and West Midlands Branch:—(1) Visit to Alfred Herbert, Limited, Coventry; (2) "Some Possibilities in Foundry-Sand Practice," Paper by J. J. Sheehan, A.R.C.Sc.I., A.I.C., at the King's Head Hotel, Coventry, at 7.30 p.m.

The Institute of Vitreous Enamellers

Southern, Midland and Northern Sections:—"Enamelling Iron." Paper by N. H. Oakley-Evans, of Armco, Limited, to be read before the Southern Section on October 24 at British Industries House, Oxford Street, London, at 8 p.m.; before the Midland Section on October 25 at the Chamber of Commerce, New Street, Birmingham, at 7.30 p.m., and before the Northern Section on October 26 at the Queens Hotel, Manchester at 7.30 p.m.

F.T.J. 18.10.34



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LIGHTNESS •
STRENGTH •
HIGH THERMAL
CONDUCTIVITY •

The "Siddeley Special" engine illustrated here is of interest to foundrymen, not only as to its crankcase and sump, but also its cylinder block and head, all of which are in "Hiduminium" R.R. 50 alloy. The connecting rods are in "Hiduminium" R.R. 56 and the pistons in R.R. 53. This photograph is shown by courtesy of HIGH DUTY ALLOYS, LTD., Slough.

BA ALUMINIUM AND LIGHT ALLOYS
The BRITISH ALUMINIUM CO. Ltd.

HEAD OFFICE: ADELAIDE HOUSE, KING WILLIAM ST., LONDON, E.C.4.
TELEPHONE MANSION HOUSE 5561 & 8074 (5 LINES) TELEGRAMS: CRYOLITE, BILGATE, LONDON

- London Warehouse: 25-29, PANCRAS RD., N.W.1
- Birmingham: 2, LAWLEY STREET
- Manchester: 274, DEANSGATE
- Leeds: 66, KIRKSTALL ROAD
- Newcastle-on-Tyne: MILBURN HOUSE
- Glasgow: 113, WEST REGENT STREET

The BRITISH ALUMINIUM CO. Ltd.

BARROW IRON

OPEN HEARTH REFINED
REFINED CUPOLA
WEST COAST HÆMATITE

Also SEMI-PHOSPHORIC
for Motor Cylinders, Valve Bodies, Steam and Hydraulic Castings, Etc.

LONDON OFFICE:
59, VICTORIA ST., S.W.1.

THE BARROW HÆMATITE STEEL CO., LTD., BARROW-IN-FURNESS, LANCS.

Raw Material Markets

The demand for pig-iron in this country is maintained at quite a good level. As future prospects in most of the consuming trades are satisfactory, it is probable that the present rate of activity will at least be maintained, if not improved upon. Current business is mostly limited to small bookings, consumers having booked ahead to the year-end, and in some cases further.

Pig-Iron

MIDDLESBROUGH.—Although the local production of pig-iron is heavier than in any other area in the country, the demand is larger than the output, and makers' stocks are being steadily reduced. Pig-iron production is now on a profit-earning basis, and the latest ascertainment shows that the net realised price of No. 3 Cleveland G.M.B. pig-iron in the third quarter of the year was 56s. 8.81d. per ton, which is an advance of 1s. 6d. per ton over the previous quarter, and the highest figure recorded since 1930. The quotations to home consumers are unchanged, No. 3 Cleveland G.M.B. being offered at 67s. 6d. per ton delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. per ton delivered Glasgow.

The producers of East Coast hematite are heavily booked over the next three months. Specifications are coming regularly to hand from consumers in this country, and in addition there is a slightly better export trade. The makers still have stocks of iron to liquidate. The minimum quotation for North-East Coast hematite—apart from export sales—remains at 69s. per ton delivered in the Middlesbrough area, with graded differences for other areas.

LANCASHIRE.—Deliveries of Midland pig-iron into this market keep up at a good level. Conditions vary in the consuming trades, but the majority of users are fairly busy and have prospects of an active winter. The light-castings trade, in particular, is very well employed. Prices are maintained, with offers of Staffordshire, Derbyshire and Lancashire iron equal to Derbyshire all quoted for delivery to users in the Lancashire zone on the basis of 74s. per ton, Northamptonshire and Lancashire iron equal to Northants at 72s. 6d., Scottish foundry at about 82s. 6d., and East Coast hematite at from 75s. for No. 3 to 76s. for No. 1, both unbroken. A quiet trade is passing locally in West Coast hematite iron at the lower rate of 78s. 6d. per ton, delivered to users in the Manchester district.

MIDLANDS.—Ordinary foundry numbers remain in good demand in this area, but the volume of new bookings is limited by reason of the large number of forward contracts that have already been negotiated. Most of the large and moderately large consumers are covered until the end of the year, or in many cases until the end of the first quarter of 1935, at the present controlled minimum rates, which are 67s. 6d. per ton for Northants No. 3 and 71s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3. These prices include delivery to Birmingham and Black Country stations, and are subject to a small rebate for large consumers. The recent slight improvement in the demand for the better grades of iron for the general engineering trade is maintained. Scottish iron is round about 85s. per ton, and other brands of similar analysis are quoted between 85s. and 87s. 6d. per ton. Medium-phosphorus pig-iron is quoted at from 72s. 6d. to 80s., and where refined iron is required, the prices range from £5 10s. to £6 15s., delivered this district.

SCOTLAND.—The demand for Scottish foundry iron fails to show improvement. Many users continue to buy from hand to mouth, and the output of the seven furnaces at present in blast is more than sufficient to meet the makers' commitments. There is no change in the official minimum of 70s. f.o.t. furnaces for No. 3 foundry, with 2s. 6d. extra for No. 1. With the demand from abroad so quiet, there is not much business passing in No. 1. The users of Cleveland iron continue to take in good supplies and about 2,000 tons a week are coming into Scotland. For No. 3 Cleveland the quotations are unaltered at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow, with other English irons obtainable at a shade less.

Coke

The foundry-coke market maintains its very firm tone, and, with the winter approaching, there is a possibility of increased quotations. Current prices for delivery in the South Staffordshire area are as follow:—Best Durham coke, 36s. to 40s.; Welsh coke, 37s. 6d. to 45s., according to analysis; Scottish low-ash coke, about 40s. per ton.

Steel

Although there is some irregularity in the rate of operations at the British works, a gradual increase in the volume of business seems to be taking place, states the official report of the London Iron and Steel Exchange. In the semi-finished steel department there has been a noticeable relaxation in the competition of imported Continental steel, and as a result the position of the British works manufacturing this material has been improved. Many consumers are carrying considerable stocks; but of late the buying in this department has been more active than for some time. Business in finished steel has broadened and the home demand is absorbing good quantities. The Admiralty order for destroyers and other contracts for new ships have improved the position at the shipyards, and later on will be reflected in important orders for the steelworks. Several of the British works are also busy on export contracts, the demand from oversea having increased during recent weeks.

Scrap

There is a steady demand for scrap iron in most areas. In the Cleveland district there is a ready market for ordinary heavy cast iron at 50s. per ton and for machinery metal at 52s. 6d., but offers for light metal do not exceed 41s., delivered. Conditions in the Midlands market are unchanged, prices remaining firm. In South Wales, current quotations are 47s. 6d. to 48s. 6d. for heavy cast iron, 41s. 6d. to 42s. 6d. for light metal, and 52s. 6d. for good machinery scrap. In Scotland the demand for good, clean heavy machinery cast-iron scrap, in pieces not exceeding 1 cwt., remains poor, and few sales are reported even at 54s. to 55s. per ton, ordinary cast iron to the same specification being at 51s. 3d. per ton.

Metals

Copper.—The copper market has remained in a nervous condition. Quotations strengthened slightly towards the end of last week, but a further setback occurred at the reopening on Monday. The consumption of copper in this country is quite heavy for the time of year, brass manufacturers and cable works being actively engaged. The consuming industries on the Continent, however, are not so well situated. The consumption of copper in Germany, in particular, is being even further restricted, at the order of the Government. Meanwhile, production of copper continues to expand in many parts of the world, particularly in the British Empire. Of recent years, also, there has been an increasing supply of copper from those mines which are primarily producers of gold, silver or nickel. In some quarters this factor is thought to have played an important part in bringing the price of copper down to its present low level.

Daily market prices :—

Cash.—Thursday, £25 18s. 9d. to £26; Friday, £26 10s. to £26 11s. 3d.; Monday, £26 to £26 1s. 3d.; Tuesday, £25 16s. 3d. to £25 17s. 6d.; Wednesday, £26 to £26 1s. 3d.

Three Months.—Thursday, £26 5s. to £26 6s. 3d.; Friday, £26 16s. 3d. to £26 17s. 6d.; Monday, £26 6s. 3d. to £26 7s. 6d.; Tuesday, £26 2s. 6d. to £26 3s. 9d.; Wednesday, £26 6s. 3d. to £26 7s. 6d.

Tin.—There is a fairly good demand for tin from consumers in this country. The Welsh tinplate industry has lately been operating at the high rate of 72 per cent. of capacity, and motor-car manufacturers will shortly be expanding their activities.

Quotations for tin on the London market have ruled firm. "Fluctuations, though light, have been confined more particularly to the nearer positions, the forward price remaining comparatively steady. The artificiality of the market has rather undermined confidence and, with the future course of prices so difficult in the circumstances to determine, buyers restrict their purchases to actual requirements and sellers at the same time adopt a cautious attitude," state Messrs. Rudolf Wolff in their weekly report.

Price fluctuations :—

Cash.—Thursday, £230 15s. to £231; Friday, £231 17s. 6d. to £232; Monday, £231 to £231 5s.; Tuesday, £231 to £231 5s.; Wednesday, £231 to £231 5s.

Three Months.—Thursday, £228 12s. 6d. to £228 17s. 6d.; Friday, £229 12s. 6d. to £229 17s. 6d.; Monday, £229 to £229 5s.; Tuesday, £229 5s. to £229 10s.; Wednesday, £229 5s. to £229 7s. 6d.

Spelter.—Although the galvanising trade is still very slack, brass manufacturers and zinc rollers are quite active, and there is consequently a good demand for spelter on the London market. Supplies of Empire (duty-free) metal remain very scarce.

Day-to-day quotations :—

Ordinary. — Thursday, £11 18s. 9d.; Friday, £12 5s.; Monday, £12; Tuesday, £11 16s. 3d.; Wednesday, £12.

Lead.—"There has been little change in the lead market and prices have remained low. In this country the tendency for the cablemakers' business to improve is continuing, and the prospects of increasing tonnages being used in the electrical industries are good. In the building trade, however, the outlook is not quite so good and the demand for pipe and sheet lead has been rather slower of late," report Messrs. Brandeis, Goldschmidt.

Price fluctuations have been as follow :—

Soft Foreign (Prompt).—Thursday, £10 5s.; Friday, £10 10s.; Monday, £10 5s.; Tuesday, £10; Wednesday, £10 3s. 9d.

Notes From the Branches

The Middlesbrough Branch of the Institute of British Foundrymen opened its winter session on Friday night with a reception of members and their friends at the Cleveland Technical Institute. The social side of the Branch has now become a feature of its activities, and Friday's event enabled members to meet Mr. Roy Stubbs, of Manchester, the President of the Institute, and his wife.

Mr. Stubbs was supported by Mr. H. Winterton, of Glasgow, Vice-President, and Mrs. Winterton, and the guests were received by the Branch-President, Mr. J. Hackwood, assisted by his wife.

In his presidential address, Mr. Hackwood expressed the hope that the coming session would see an increase in membership. The Middlesbrough Branch was already very well represented, but there were still a few who remained outside their organisation.

Mr. Stubbs, in thanking the Branch for its welcome, said there never was a time when craftsmanship was in so much demand as at present. The mechanisation of the foundries did not mean that skilled craftsmanship was done away with; it was only transferred to some other source. He hoped that the younger generation in the foundry industry would take advantage of their opportunities and make themselves worthy of the traditions established by the hard-working pioneers. Mr. Stubbs added that there was a definite improvement in the industry, but real and lasting success would only come about by hard work, pertinacity and imagination.

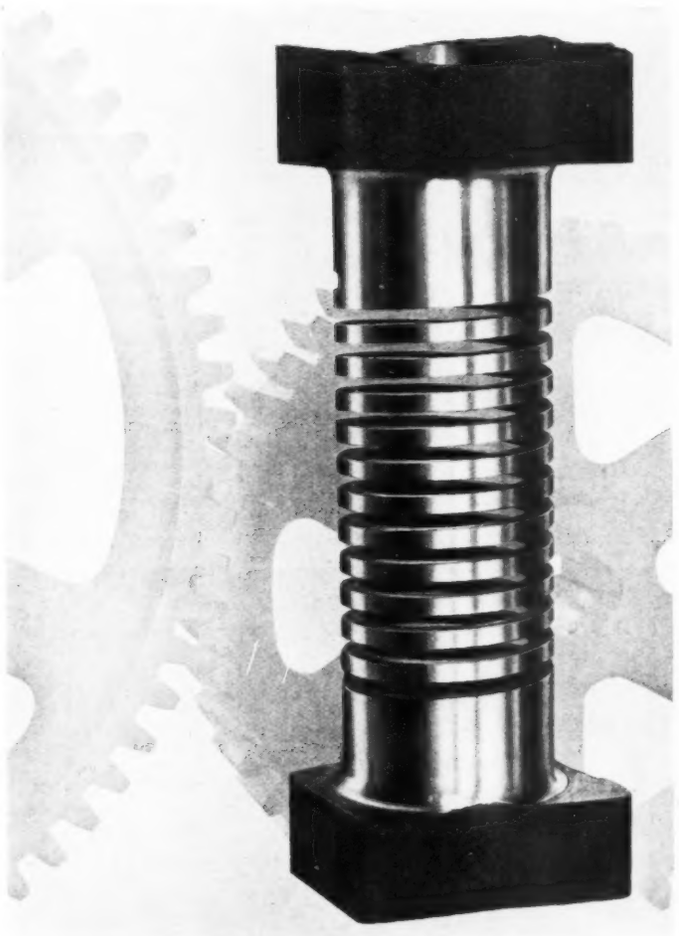
The chief prize winners at the whist drive, for which Mr. F. A. Harper, the Branch hon. secretary, acted as M.C., were:—Ladies: 1, Mrs. R. Stubbs; 2, Mrs. J. K. Smithson. Gentlemen: 1, Mr. R. Lyall; 2, Mr. T. Clulow. The prizes were distributed by Mrs. Hackwood. Mr. Harper, the Branch hon. secretary, has produced an attractive programme for the session.

Messrs. Henry Foster & Company, Limited, Backworth, Newcastle-upon-Tyne, supplied their special "Foster" firebricks required for the oil burners, etc., in the Cunard-White Star liner "Queen Mary" (No. 534)

"Cogs in the Wheel of Progress—"

An expression aptly applying to

"NEW PROCESS" REFINED IRONS



Today, the use of such irons eliminate all "ifs and buts"—the high quality of the finished casting is assured.

Illustrated, a piece of "New Process" refined pig iron, machined to form a 3″ dia. spiral, provides an excellent example of the close uniform grain, free from porosity and segregation, and the high physical properties which make such machining possible.

ARMSTRONG CLOSE WORKS — SIR W. G. ARMSTRONG WHITWORTH & CO. (IRONFOUNDERS) LIMITED — WHITWORTH GATESHEAD ON TYNE

Telephone: Gateshead 71181. ***Telegraph: "Closework, Gateshead-on-Tyne."***

RAW MATERIALS—PRICE LIST

(Wednesday, October 17, 1934)

COPPER

	£	s.	d.
Standard cash	26	0	0
Three months	26	6	3
Electrolytic	28	10	0
Tough	27	15	0
Best selected	28	5	0
Sheets	56	0	0
India	38	15	0
Wire bars	29	2	6
Ingot bars	29	2	6
H.C. wire rods	31	15	0
Off. av. cash, September	27	11	6¾
Do., 3 mths., September	27	17	6
Do., Sttlmnt., September	27	11	10½
Do., Electro, September	30	15	8¼
Do., B.S., September	30	13	1½
Do., wire bars, September	31	0	3
Solid drawn tubes			9¼d.
Brazed tubes			9¼d.
Wire			6d.

BRASS

Solid drawn tubes	8½d.
Brazed tubes	10½d.
Rods, drawn	8d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	6¾d.
Wire	7d.
Rolled metal	6¾d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	231	0	0
Three months	229	5	0
English	231	0	0
Bars	232	17	6
Straits	231	2	6
Australian (nom.)	—		
Eastern	230	0	0
Banca	232	15	0
Off. av. cash, September	230	0	0¾
Do., 3 mths., September	227	17	3
Do., Sttlmt., September	230	1	0

SPELTER

	£	s.	d.
Ordinary	12	0	0
Remelted	13	0	0
Hard	10	0	0
Electro 99.9	14	12	6
English	13	2	6
India	12	0	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., September	12	14	10⅞
Aver. spot, September	12	12	10½

LEAD

	£	s.	d.
Soft foreign ppt.	10	3	9
Empire (nom.)	11	0	0
English	12	5	0
Off. average, September	10	10	0
Average spot, September	10	7	9

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex whse.	22	10	0
Rods	26	10	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	48	0	0	to 50	0	0	
Chinese, ex-whse.				43	0	0	
Crude					—		

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to 11	10	0	

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	13 0 0
75%	18 7 6
Ferro-vanadium —	
35 50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	5/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	29 15 0
4/6% car.	23 0 0
6/8% car.	21 12 6
8/10% car.	21 12 6
Ferro-chrome—	
Max. 2% car.	36 0 0
Max. 1% car.	38 15 0
Max. 0.70% car.	42 0 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 to 5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel					2	15	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to 2	12	0	
Heavy cast iron	2	7	6	to 2	8	6	
Good machinery					2	12	6
Cleveland—							
Heavy steel					2	10	0
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	10	0	to 2	12	6	
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					2	17	6
Steel turnings, f.o.r.					1	13	0
Scotland—							
Heavy steel	2	10	0	to 2	11	6	
Ordinary cast iron					2	11	3
Engineers' turnings					1	19	9
Cast-iron borings	1	19	0	to 2	0	0	
Wrought-iron piling	2	10	0	to 2	11	3	
Heavy machinery	2	14	0	to 2	15	0	

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	24	0	0
Brass	15	10	0
Lead (less usual draft)	9	10	0
Tea lead	7	0	0
Zinc	9	0	0
New aluminium cuttings	66	0	0
Braziery copper	19	0	0
Gunmetal	22	0	0
Hollow pewter	145	0	0
Shaped black pewter	110	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0	
Nut and bolt iron	7	10	0	to 8	0	0	
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.				12	0	0	
Gas strip	10	10	0	and up.			
Bolts and nuts, ¾ in. × 4 in.				14	0	0	
Steel—							
Plates, ship, etc.	8	15	0	to 8	17	6	
Boiler plts.	8	0	0	to 8	10	0	
Chequer plts.				10	7	6	
Angles				8	7	6	
Tees				9	7	6	
Joists				8	15	0	
Rounds and squares, 3 in. to 5½ in.				9	7	6	
Rounds under 3 in. to ⅜ in. (Untested)				8	12	0	
Flats—8 in. wide and over				8	12	6	
,, under 8 in. and over 5 in.				8	17	6	
Rails, heavy	8	5	0	to 8	10	0	
Fishplates	12	5	0	to 12	10	0	
Hoops (Staffs)				9	7	0	
Black sheets, 24g. (4-t. lots)				10	10	0	
Galv. cor. shts. (,,)				13	0	0	
Galv. flat shts. (,,)				13	10	0	
Galv. fencing wire, 8g. plain				14	10	0	
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to 7	2	6	
Sheet bars	5	2	6	to 5	10	0	
Tin bars	5	2	6	to 5	7	6	

PHOSPHOR BRONZE

	Per lb. basis
Strip	8⅞d.
Sheet to 10 w.g.	9⅝d.
Wire	11½d.
Rods	9⅝d.
Tubes	12⅜d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.25
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 21/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		18/2
,,	28×20 ,,		36/4
,,	20×10 ,,		26/-
,,	18⅞×14 ,,		18/7½ to 18/9
C.W.	20×14 ,,		15/7½
,,	28×20 ,,		33/9 to 34/-
,,	20×10 ,,		23/-
,,	18⅞×14 ,,		16/-

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to £7	0	0	
Bars-hammered, basis	£16	0	0	to £16	10	0	
Bars and nail-rods, rolled, basis	£15	15	0	to £16	0	0	
Blooms	£10	0	0	to £12	0	0	
Keg steel	£30	0	0	to £31	0	0	
Faggot steel	£18	0	0	to £23	0	0	
Bars and rods dead soft, st'l	£10	0	0	to £12	0	0	

All per English ton. f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.		
Oct.	11 ..	25	18	9	inc.	6/3
,,	12 ..	26	10	0	,,	11/3
,,	15 ..	26	0	0	dec.	10/–
,,	16 ..	25	16	3	,,	3/9
,,	17 ..	26	0	0	inc.	3/9

Electrolytic Copper

		£	s.	d.		
Oct.	11 ..	28	15	0	inc.	10/–
,,	12 ..	29	0	0	,,	5/–
,,	15 ..	28	10	0	dec.	10/–
,,	16 ..	28	10	0	No change	
,,	17 ..	28	10	0	,, ,,	

Standard Tin (cash)

		£	s.	d.		
Oct.	11 ..	230	15	0	inc.	10/–
,,	12 ..	231	17	6	,,	22/6
,,	15 ..	231	0	0	dec.	17/6
,,	16 ..	231	0	0	No change	
,,	17 ..	231	0	0	,, ,,	

Tin (English ingots)

		£	s.	d.		
Oct.	11 ..	231	0	0	inc.	15/–
,,	12 ..	232	0	0	,,	20/–
,,	15 ..	231	5	0	dec.	15/–
,,	16 ..	231	0	0	,,	5/–
,,	17 ..	231	0	0	No change	

Spelter (ordinary)

		£	s.	d.		
Oct.	11 ..	11	18	9	inc.	3/9
,,	12 ..	12	5	0	,,	6/3
,,	15 ..	12	0	0	dec.	5/–
,,	16 ..	11	16	3	,,	3/9
,,	17 ..	12	0	0	inc.	3/9

Spelter (Electro, 99.9 per cent.)

		£	s.	d.		
Oct.	11 ..	14	10	0	inc.	5/–
,,	12 ..	14	16	3	,,	6/3
,,	15 ..	14	12	6	dec.	3/9
,,	16 ..	14	10	0	,,	2/6
,,	17 ..	14	12	6	inc.	2/6

Zinc Sheets (English)

		£	s.	d.		
Oct.	11 ..	23	10	0	No change	
,,	12 ..	23	10	0	,,	,,
,,	15 ..	23	10	0	,,	,,
,,	16 ..	23	10	0	,,	,,
,,	17 ..	23	10	0	,,	,,

Lead (English)

		£	s.	d.		
Oct.	11 ..	12	5	0	No change	
,,	12 ..	12	10	0	inc.	5/–
,,	15 ..	12	5	0	dec.	5/–
,,	16 .	12	5	0	No change	
,,	17 ..	12	5	0	,,	,,

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in September and the nine months, 1934, compared with a year ago.

	September.		Nine months.		September.		Nine months.	
	1933.	1934.	1933.	1934.	1933.	1934.	1933.	1934.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron, forge	—	—	—	—	—	—	—	—
,, foundry	3,366	1,053	27,591	22,336	11,665	3,135	97,964	64,477
,, acid	—	—	37	—	—	—	226	—
,, basic	1,000	6,954	40,333	54,264	2,649	19,837	107,852	149,813
Total (including other kinds)	4,366	9,358	67,961	87,546	14,314	31,225	206,042	277,439
Castings and forgings	64	288	743	3,012	1,709	6,132	17,567	75,151
Cast pipes and fittings	84	42	978	806	1,489	2,462	19,538	44,562
Stoves, grates, etc.	232	82	652	852	10,642	7,117	49,443	69,936
Baths	1,106	737	5,086	5,957	25,811	18,371	118,308	147,573
Hollow-ware, all kinds	242	159	1,805	1,778	10,891	8,914	74,006	101,789
Exports.								
Pig-iron, forge	109	181	1,631	910	423	791	6,387	3,815
,, foundry	3,897	4,583	34,790	53,075	13,737	17,336	121,725	181,022
,, acid	3,920	2,980	38,008	32,950	12,770	9,332	118,261	104,151
,, basic	212	—	1,242	832	746	—	4,783	2,725
Total	8,138	7,744	75,671	87,767	27,676	27,459	251,156	291,713
Castings and forgings	217	400	2,003	3,861	8,212	17,986	84,174	149,904
Cast pipes and fittings, up to 6 in. diameter	3,942	4,217	36,267	45,287	46,585	50,161	400,084	502,362
,, ,, ,, over 6 in. ,,	3,044	1,336	22,522	26,668	23,261	11,625	163,611	197,944
Stoves, grates, etc.	617	647	4,786	6,361	28,701	37,557	230,128	304,321
Sanitary cisterns	319	225	1,939	2,190	8,810	6,532	56,895	64,302
Bedsteads, inc. tubes therefor	333	314	2,886	3,829	11,201	11,118	105,527	126,335
Cast hollow-ware	353	401	3,026	2,692	13,580	14,565	120,840	102,251

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